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Missouri's Forest Resource, 1989: an Analysis

John S. Spencer, Jr., Sue M. Roussopoulos, and Robert A. Massengale

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This report includes the most commonly used Forest Inventory and Analysis statistics. However, additional forest resource data can be provided to interested users. Persons requesting additional information from the raw inventory data are expected to pay the retrieval costs. These costs range from less than $100 for a relatively simple request to $2,000 for a complex retrieval involving the services of a Forest Inventory and Analysis computer programmer. Requests will be filled so as to minimize the impact on the Forest Inventory and Analysis Work Unit.

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FOREWORD

Forest Inventory and Analysis (FIA) is a continuing endeavor as mandated by the Renewable Resources Research Act of 1978. Prior inventories were mandated by the McSweeney-McNary Forest Research Act of 1928. The objective of FIA is to periodically inventory the Nation's forest land to determine its extent, condition, and the volume of timber, growth, and depletions. Up-to-date resource information is essential to frame intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for forest inventory and analysis in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin.

Fieldwork for the Missouri Statewide forest inventory was begun in January 1987 and completed in June 1989. The three previous forest inventories of Missouri were completed in 1947 (King *et al.* 1949), 1959 (Gansner 1965), and 1972 (Spencer and Essex 1976).

More accurate survey information was obtained during the 1989 survey than otherwise would have been feasible because of intensified field sampling. Such sampling was made possible by additional funding provided by the Missouri Department of Conservation. The Department also surveyed primary wood-using plants in the State (Smith and Jones 1990). Data from this survey were used to help estimate the quantity of timber products harvested in the State. Missouri Department of Conservation personnel also assisted in training field personnel, analyzing information obtained from the survey, and preparing this report.

Aerial photos used in the Missouri Forest Inventory were furnished by the USDA Agricultural Stabilization and Conservation Service and the Missouri Department of Natural Resources, Division of Geology and Land Survey.

HIGHLIGHTS

NOTE: *Data from new forest inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparisons to be valid, the procedures used in the two inventories must be similar. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have occurred since 1972. Because some of these changes would make it inappropriate to directly compare the 1989 data with those published for 1972, data from the 1972 inventory were reprocessed using the 1989 procedures and were published in part in the State statistical report (Hahn and Spencer 1991). Please refer to the Appendix section labeled "Comparing Missouri's fourth inventory with the third inventory" for more details.*

AREA

- Missouri's forest land area increased from 12.9 million acres in 1972 to 14.0 million acres in 1989. Much of the increase came from reversion of lands previously classified as nonforest land with trees (see Definition of Terms in Appendix).
- Timberland area expanded from 12.4 million acres in 1972 to 13.4 million acres in 1989. The primary reason for this increase is the reversion of wooded pasture and improved pasture to timberland.
- Shannon County (467 thousand timberland acres), Reynolds County (426 thousand timberland acres), and Texas County (413 thousand timberland acres) contain the largest timberland areas in the State.
- The black-scarlet oak forest type covers the largest timberland area in the State (4.9 million acres), followed by the white oak (3.0 million acres) and post-blackjack oak forest types (2.4 million acres).
- Sawtimber stands accounted for 49 percent of timberland area in 1989, compared to 39 percent in 1972. The area of poletimber stands declined between 1972 and 1989 as stands shifted into sawtimber.
- Only 6 percent of the State's timberland area supports more than 5,000 board feet of timber per acre.
- Stands less than 50 years old make up 53 percent of timberland area.
- Nonindustrial private owners hold 83 percent of the State's timberland.
- Sixty-two percent of the privately owned timberland has been held by the same owner for more than 10 years, and more than half is in parcels smaller than 100 acres.
- Twenty-four percent of stands grow trees taller than 70 feet at age 50.

NUMBER OF TREES

- The number of growing-stock trees 5.0 inches in diameter and larger rose from 874 million to 1.1 billion from 1972 to 1989, an increase of 29 percent.

TIMBER VOLUME

- Growing-stock volume on timberland increased from 6.5 to 9.0 billion cubic feet between 1972 and 1989, a 38-percent gain.
- Sawtimber volume expanded from 17.0 to 25.9 billion board feet, a 52-percent increase.
- The Eastern Ozarks Survey Unit contains the largest share of the growing-stock volume (34 percent), and five of the six counties with the largest volumes are in that Survey Unit (Shannon, Reynolds, Wayne, Washington, and Iron Counties).

- Hardwoods account for 8.1 billion cubic feet of the 9.0 billion total growing-stock volume. Oak species alone account for 5.9 billion cubic feet.

- Nongrowing-stock trees (rough, rotten, short-log, and salvable dead trees) add another 4.9 billion cubic feet to the 9.0 billion of growing-stock volume. Most of the nongrowing-stock volume (3.3 billion) is in rough trees.

- Growing-stock volume in every 2-inch diameter class gained substantially between 1972 and 1989.

- Stands aged 41 to 60 years account for 31 percent of total growing-stock volume, more than any other age class. Stands older than 90 years account for 12 percent of the volume.

- Nonindustrial private owners hold 82 percent of the State's hardwood growing-stock volume, but only 52 percent of the softwood volume.

- Average volume per acre of growing stock on timberland rose from 526 to 672 cubic feet between 1972 and 1989.

- Eighty-six percent of the sawtimber volume is in the two poorest butt log grades of the four grades used. (See Appendix for log grades used.)

GROWTH AND MORTALITY

- Volume of net annual growth of growing stock increased from 157 million cubic feet in 1971 to an average of 267 million cubic feet during the period 1972 to 1988. Sawtimber growth rose from 581 million to 1 billion board feet during the same period.

- Growing-stock growth on timberland averaged 12.7 cubic feet per acre in 1971, but increased to 20.0 cubic feet in 1972-1988.

- Average annual mortality of growing stock increased from 32.6 million cubic feet in 1971 to 73.7 million cubic feet during the period 1972 to 1988.

- Oak decline, a complex interaction of environmental stresses and forest pests, was a major cause of oak mortality during the period 1972 to 1988.

REMOVALS

- Annual growing-stock removals for 1971 were 168 million cubic feet, compared to 136 million cubic feet in 1987; average annual removals were 117 million cubic feet during the period 1972 to 1988.

- Annual sawtimber removals for 1971 were 542 million board feet, compared with 492 million board feet for 1987; average annual removals were 409 million board feet during the period 1972 to 1988.

- Average annual removals amounted to only 44 percent of average annual growth during the period 1972 to 1988.

PROJECTIONS

- The low removals option projection shows growing-stock inventory rising from 9.0 billion to 13.6 billion cubic feet from 1989 to 2019, a 51-percent gain. Growth exceeds removals throughout the projection period.

- The high removals option projection shows growing-stock inventory increasing from 9.0 billion to 12.0 billion cubic feet from 1989 to 2019, a 33-percent gain, but the rate of increase during the last two decades is slower than for the low option.

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In 1989 the fourth Missouri forest inventory found 14.0 million acres of forest land, of which 13.4 million acres (96 percent) is timberland. Growing-stock volume increased from 6.5 to 9.0 billion cubic feet between 1972 and 1989. Analysis and statistics on forest area, timber volume, growth, removals, mortality, and projections are presented.

KEY WORDS: Area, volume, growth, removals, mortality.

The authors acknowledge the invaluable contributions of FIA photo interpreters and field crews to the Missouri forest inventory. Their hard work and commitment to accuracy are too often overlooked. This survey could not have been accomplished without them.

Missouri's Forest Resource, 1989: An Analysis

John S. Spencer, Jr., Sue M. Roussopoulos, and Robert A. Massengale

At the time Europeans settled Missouri, an estimated 2 of every 3 acres were forested. In 1989 about 1 of every 3 acres in the State was forested. Although the forest has shrunk, it is still a solid and enduring presence of vital importance to the well-being of Missouri's citizens and to the Nation. Clean water, deer, wild turkeys, the sound of song birds, and the opportunity for solitude are all part of the forest's bounty. Missouri oak is shipped across the country and throughout the world to be transformed into useful and beautiful products.

The forest is dynamic—seeds germinate and grow; trees age and die or are killed by insects, disease or fire; or they are harvested to provide fuel, shelter, and other products that improve our lives. This report discusses recent forest statistics for the State, and some of the reasons for the change from the earlier inventory.

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FOREST AREA INCREASES

Missouri's forest land area increased by 8 percent (1.1 million acres) between the 1972 and 1989 surveys. Forest land now accounts for 32 percent (14.0 million acres) of the State's land area, compared with 29 percent (12.9 million acres) in 1972 (table 1). This increase offsets the reported decline in forest area between the 1959 and 1972 inventories.

For the most part, the increase in forest area results from a reclassification of lands that had been called wooded pasture in 1972 but that showed no evidence of grazing in the most recent survey (fig. 1). Pastureland declined 14 percent (2.5 million acres) between 1972 and 1989 with 80 percent of this loss occurring in the wooded pasture class. However, pastureland still accounts for 34 percent (15.1 million acres) of the State's land area. The other major land class in Missouri is farmland, which is estimated at 11.7 million acres (27 percent).

Figure 1.—*The area of wooded pasture, one of several classifications of treed land that are not considered forest land by FIA definition, declined between 1972 and 1989.*

Table 1.—*Area of land by Forest Survey Unit and major land-use class, Missouri, 1989*

(In thousand acres)

Survey Unit	Land area	Forest land			
		All forest land	Timber-land	Reserved forest land	Other forest land
Eastern Ozarks	6,135.5	4,300.3	4,110.0	159.1	31.2
Southwest Ozarks	5,435.0	2,613.4	2,498.2	52.8	62.4
Northwest Ozarks	4,993.8	2,313.4	2,169.6	27.2	116.6
Prairie	19,541.3	2,532.5	2,500.3	16.9	15.3
Riverborder	8,019.3	2,238.6	2,092.7	60.9	85.0
All Units	44,124.9	13,998.2	13,370.8	316.9	310.5

Wooded strips, which are too narrow to qualify as forest land, account for 295 thousand acres, primarily in the Prairie Survey Unit. These areas are a vital source of resting and hiding cover for wildlife and provide protection from stream-side erosion.

Ninety-six percent (13.4 million acres) of forest land is classified as timberland. This represents an increase of 1.0 million acres (8 percent) since the previous survey. Reserved forest land, primarily parks and wilderness set aside from timber harvest, makes up another 2 percent (317 thousand acres) of forest land. The remaining two percent (311 thousand acres) of forest land is on poor sites and incapable of producing 20 cubic feet or more of wood per acre annually.

EASTERN OZARKS HEAVILY FORESTED

The Eastern Ozarks Survey Unit is the most heavily forested region in Missouri (fig. 2). Thirty-one percent (4.1 million acres) of the State's timberland occurs in this Unit that accounts for only 14 percent of total land area in the State. Missouri's remaining timberland area is rather evenly distributed among the other four Survey Units.

Timberland area in four Survey Units increased between inventories but the Riverborder Unit declined by less than 1 percent, perhaps because of urban expansion (fig. 3). Fifty-five percent (560 thousand acres) of the increase in timberland area occurred in the Prairie Survey Unit, where wooded pasture declined by 701 thousand acres.

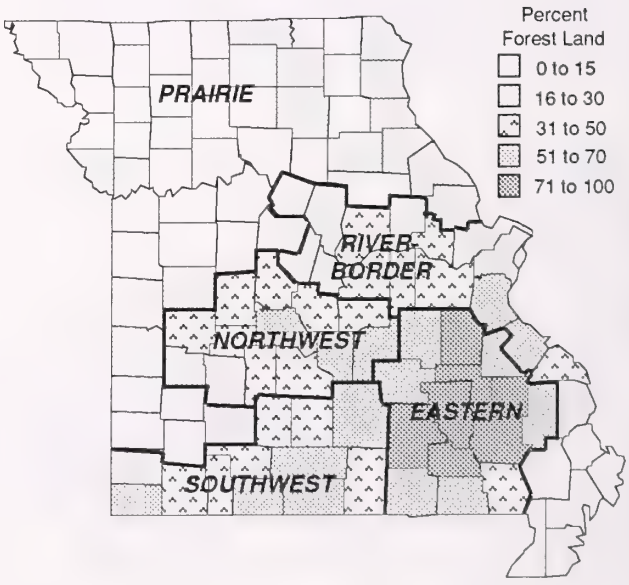


Figure 2.—*Forest land area as a percent of land area, by county, Missouri, 1989.*

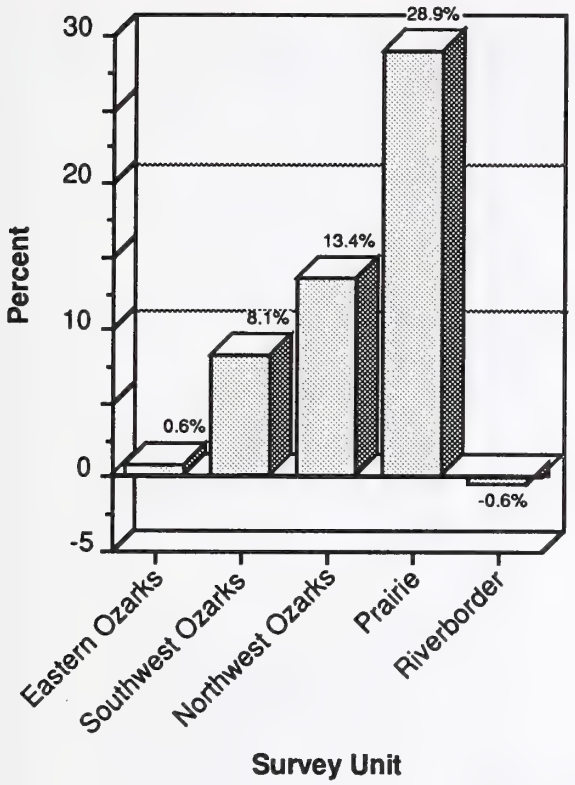


Figure 3.—*Percent change in timberland area from 1972 to 1989, by Survey Unit, Missouri, 1989.*

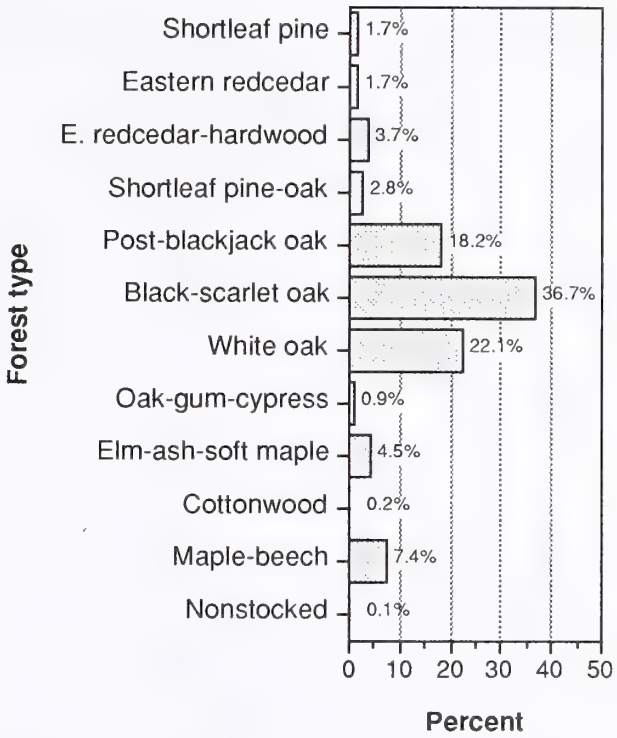


Figure 4.—*Percent timberland area by forest type, Missouri, 1989.*

At 467 thousand acres, Shannon County in the Eastern Ozarks Survey Unit has more timberland than any other county in Missouri. Eighty-two percent of Carter County's land area is in timberland, the highest proportion in the State.

OAK TYPES DOMINATE

Oak forest types cover 77 percent (10.3 million acres) of Missouri's timberland area, with the black-scarlet oak type alone accounting for 37 percent of timberland (fig. 4). The other major forest types are maple-beech (996 thousand acres), elm-ash-soft maple (598 thousand acres), and redcedar-hardwood (489 thousand acres). As a group, softwood forest types account for only 10 percent (1.3 million acres) of timberland area.

In total, oak forest types increased by 61 thousand acres from 1972 to 1989. This increase resulted from a combined gain of 330 thousand acres in the Northwest Ozarks and Prairie Survey Units with an offsetting decline of 269 thousand acres in the remaining Units. Table 2 presents an analysis of land classification changes from 1972 to 1989. To use table 2—for example, to find what happened to the 4.9 million acres of black-scarlet oak from the 1972 survey—read across the black-scarlet oak row and note that 42 thousand acres converted to the eastern redcedar-hardwood type, 72 thousand to shortleaf pine-oak, 126 thousand to post-blackjack oak, and so on. To determine the source of the 4.9 million acres of black-scarlet oak found in the 1989 survey, read down the black-scarlet oak column. Forty-four thousand acres came from shortleaf pine-oak, 438 thousand acres came from post-blackjack oak, 3.4 million acres remained black-scarlet oak, and so on.

Table 2.--Forest land classification changes in Missouri, 1972-1989

(In thousand acres)

1972 land classification	1972 area[2]	1989 Land classification[1]												
		Timberland - forest type												Reserved forest, other forest, and nonforest
		Shortleaf pine	Eastern redcedar	Eastern redcedar-hardwood	Shortleaf pine-oak	Post-blackjack oak	Black-scarlet oak	White oak	Oak-gum-cypress	Elm-ash-soft maple	Cotton-wood	Maple-beech	Non-stocked	
Timberland														
Shortleaf pine	204.5	145.9	--	--	31.1	--	--	--	--	--	--	--	--	27.5
Eastern redcedar	100.5	--	67.5	19.6	--	--	--	--	--	--	--	--	--	13.4
E. redcedar-hardwood	228.6	--	65.8	109.4	--	--	--	5.5	--	--	--	26.2	--	21.7
Shortleaf pine-oak	296.7	45.6	--	--	158.8	16.1	44.1	16.8	--	--	--	3.7	--	11.6
Post-blackjack oak	2,784.5	--	8.1	41.1	44.5	1,771.4	437.7	105.0	--	--	--	7.0	--	369.7
Black-scarlet oak	4,937.4	--	--	42.1	71.9	125.6	3,442.5	579.6	--	1.8	--	131.8	--	542.1
White oak	2,512.1	5.8	6.7	24.9	23.0	--	152.3	1,944.3	--	--	--	65.7	--	289.4
Oak-gum-cypress	125.1	--	--	--	--	--	--	--	114.1	11.0	--	--	--	--
Elm-ash-soft maple	558.4	--	--	--	--	--	9.8	5.9	3.2	299.4	--	127.1	--	113
Cottonwood	17.1	--	--	--	--	--	--	--	--	1.0	3.8	--	--	12.3
Maple-beech	579.1	--	--	12.2	--	--	95.4	41.3	--	48.4	--	239.4	--	142.4
Nonstocked	10.5	--	--	--	--	--	8.4	--	--	--	2.1	--	--	--
Reserved forest, other forest, and nonforest	31,770.4	35.5	76.9	239.6	41.5	517.4	722.0	253.7	--	236.1	23.4	394.8	18.5	29,211.0
All land classes	44,124.9	232.8	225.0	488.9	370.8	2,430.5	4,912.2	2,952.1	117.3	597.7	29.3	995.7	18.5	30,754.1
Percent net change (1972-1989)		13.8	123.9	113.9	25.0	-12.7	-0.5	17.5	-6.2	7.0	71.3	71.9	76.2	-3.2

[1]Read across rows to determine dispersion of 1972 classes to 1989 classes. Read down columns to determine origin of 1989 classes.
[2]Total land area adjusted to conform to 1980 census figures.

The white oak type gained 440 thousand acres (18 percent) and is now the second largest forest type in the State (table 2). As oak-hickory forests mature, they commonly progress from oak types that tolerate drier conditions and little shade to white oak that prospers on more mesic sites. The 2.9 million acres that made up the white oak type in 1989 include not only 1.9 million acres that remained white oak from 1972, but also 580 thousand acres from the 1972 black-scarlet oak type, 254 thousand acres from non-timberland, and 105 thousand acres from the post-blackjack oak type. The remaining 70 thousand acres came from several other forest types. The largest increase in white oak occurred in the Eastern Ozarks Survey Unit, which gained 264 thousand acres (fig. 5).

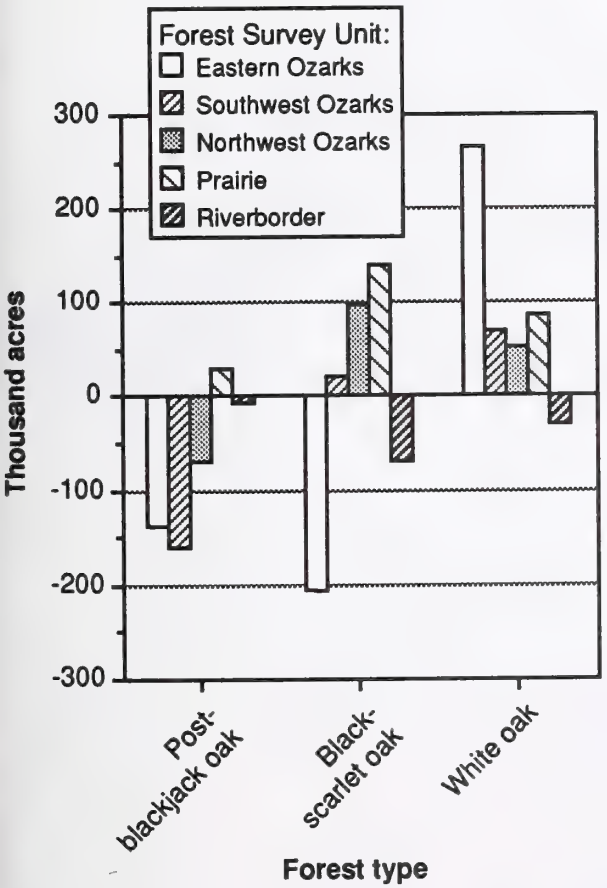


Figure 5.—*Change in timberland area of oak forest types between 1972 and 1989, by Survey Unit, Missouri, 1989.*

The post-blackjack oak type declined by 13 percent (354 thousand acres) from 1972 to 1989. In 1972 the post-blackjack oak type totaled 2.8 million acres. By 1989, 1.8 million of these acres remained post-blackjack oak, 438 thousand acres had converted to black-scarlet oak, and 105 thousand acres had converted to white oak. This reflects the expected successional progression among these oak types. Another 370 thousand acres of post-blackjack oak converted to non-timberland. The remaining 101 thousand acres converted to several other types. Eighty-five percent of the post-blackjack oak losses occurred in the Eastern and Southwest Ozark Units, while the Prairie Survey Unit actually gained 29 thousand acres (fig. 5).

Overall, the maple-beech forest type gained 417 thousand acres between 1972 and 1989 with 64 percent of the increase occurring in the Prairie Survey Unit. Forty-one percent (239 thousand acres) of maple-beech forest land in 1972 remained maple-beech in 1989. The remaining 340 thousand acres of 1972 maple-beech forest land converted to nonforest land and other types by 1989. During the same period, 756 thousand acres of other types, primarily nonforest land, black-scarlet oak, and elm-ash-soft maple, converted to the maple-beech type (fig. 6).

Figure 6.—*The area of maple-beech increased between 1972 and 1989, reflecting a natural progression to this shade-tolerant forest type in the absence of disturbance.*

Although only a minor component (less than 6 percent of timberland area), the redcedar and redcedar-hardwood types increased 124 and 114 percent, respectively, between inventories. The redcedar-hardwood type gained 111 thousand acres in the Southwest Ozarks Survey Unit alone. In the 1989 survey, 44 percent (317 thousand acres) of redcedar and redcedar-hardwood acres came from land classified as nontimberland in 1972. Much of this would have been classified timberland in 1972 had it not been grazed. Eastern redcedar is among the first species to invade abandoned fields and areas cleared for pasture on dry, shallow soils. Due to competition from hardwoods on better sites, eastern redcedar is generally confined to poorer sites with thin, rocky soil and intermittent rock outcrops—areas known as glades in the Ozarks. If these areas are left ungrazed, natural succession dictates that hardwoods will eventually replace eastern redcedar. The redcedar type provides important nesting and roosting cover for birds as well as escape cover and winter browse for deer (Lawson and Law 1983).

SAWTIMBER STANDS MOST COMMON

Of Missouri's timberland area, 49 percent is in the sawtimber stand-size class, followed by 29 and 22 percent in poletimber and sapling-seedling stands, respectively (fig. 7). Less than 1 percent of timberland area is nonstocked. A substantial shift has occurred in the sawtimber/poletimber ratio since the previous survey when sawtimber and poletimber each accounted for 39 percent of timberland area. Stands classified as poletimber in 1972 have matured and moved into the sawtimber class. The area of sapling-seedling stands did not change from the previous survey.

The redcedar and redcedar-hardwood forest types are conspicuous with 40 percent (283 thousand acres) of their combined area in sapling-seedling stands and the remainder evenly distributed between sawtimber and poletimber. As mentioned above, this is a reflection of reduced grazing pressure and the consequent expansion of these types.

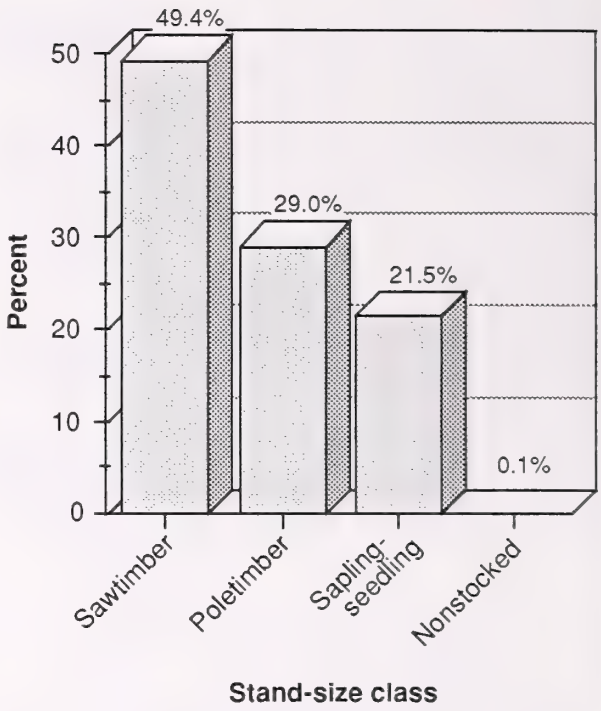


Figure 7.—*Area of timberland by stand-size class, Missouri, 1989.*

Oak-hickory seed, also known as mast, is an important wildlife food source in late summer, fall, and winter (fig. 8). In the Ozarks, acorns comprise 32 percent of the fall and winter diet of wild turkeys and 50 to 75 percent of the year-long diet of white-tailed deer (Dellinger 1973). The production of 100 pounds of oak mast per acre is needed to sustain reasonable wildlife densities (Shaw 1971). This is roughly equivalent to a basal area of 25 to 30 square feet per acre in oaks large enough to produce seed—10 or more inches d.b.h. (Yoakam *et al.* 1980). Thirty-eight percent of Missouri's timberland resource (5.1 million acres) is in stands that approach this standard, *i.e.*, oak forest types where sawtimber basal area exceeds 30 square feet per acre. However, these stands are not pure oak and not all trees are sawtimber size.

Figure 8.—*Acorns are a vital part of the diet of Missouri's white-tailed deer.*

Management plans to provide habitat for cavity-dependent wildlife should consider live trees as well as snags. The percentage of live tree cavities increases with diameter for oak species in Missouri. Allen and Corn (1990) found in an inspection of 3,400 oaks on the Mark Twain National Forest that all black, white, and scarlet oaks greater than 21.8, 22.6, and 25.0 inches d.b.h., respectively, had one or more cavities. The proportion of trees with cavities was much higher for black (30.1 percent) and scarlet oak (21.1 percent) than for white oak (9.9 percent), indicating that retention of black and scarlet oak over white oak may increase cavity availability. However, because white oak is longer lived, large trees with existing cavities should be retained. Table 3 estimates the number of black, scarlet, and white oaks greater than 23 inches d.b.h. in Missouri along with the percent with cavities based on FIA field crew observations.

MEDIAN STAND AGE IS 50 YEARS

Slightly more than 50 percent of Missouri's timberland is occupied by stands less than 50 years of age (table 4). The maple-beech and eastern redcedar forest types are more heavily weighted toward younger age classes. Seventy-two percent of the maple-beech type and 70 percent of the redcedar type are in stands less than 50 years of age with large components of each in the 11- to 20-year class.

Oaks do not begin to produce significant seed crops until age 40 to 50 (Goodrum *et al.* 1971). Maintaining oak stands in which trees 50 years and older make up at least 50 percent of the stand will maximize the potential for acorn yields (Kubisiak 1991). FIA estimates indicate that 50 percent (5.2 million acres) of Missouri's oak-hickory resource is at least 50 years old.

Twelve percent (1.2 million acres) of oak-hickory timberland is older than 90 years. A sawtimber rotation length of 75 to 90 years is recommended for oaks when site index falls between

Table 3.—*Number of all live trees on timberland and percent containing cavities by individual species and diameter class, Missouri, 1989*

Species	Diameter class (inches)					
	23.0 to 28.9	29.0 to 38.9	39.0+	23.0 to 28.9	29.0 to 38.9	39.0+
	Thousands of trees			*Percent with cavities*		
Black oak	1,319	225	15	30.7	37.8	60.0
Scarlet oak	183	26	1	25.1	11.5	0.0
White oak	1,420	216	10	23.1	32.4	40.0
Total	2,922	467	26			

Table 4.—*Area of timberland by forest type and stand-age class, Missouri, 1989*
(In thousand acres)

Forest type	All ages	Stand-age class (years)				
		1-20	21-50	51-70	71-90	91+
Shortleaf pine	232.8	18.0	124.3	59.3	31.2	--
Eastern redcedar	225.0	104.4	53.6	25.4	26.8	14.8
E. redcedar-hardwood	488.9	163.3	121.9	88.7	69.3	45.7
Shortleaf pine-oak	370.8	49.1	158.9	101.5	47.3	14.0
Post-blackjack oak	2,430.5	578.0	755.1	573.0	264.5	259.9
Black-scarlet oak	4,912.2	983.3	1,693.4	1,033.7	837.0	364.8
White oak	2,952.1	379.2	727.8	612.3	643.9	579.9
Oak-gum-cypress	117.3	3.4	54.3	32.1	18.4	9.1
Elm-ash-soft maple	597.7	71.5	294.5	153.9	60.7	17.1
Cottonwood	29.3	--	14.3	8.0	7.0	--
Maple-beech	995.7	323.8	388.0	198.8	39.7	45.4
All types	13,352.3	2,674.0	4,386.1	2,886.7	2,045.8	1,359.7

55 and 74 feet (Sander 1977). With weighted average site indices for oak forest types in Missouri ranging from 55 to 65 feet, these 1.2 million acres could be considered overmature. Generally speaking, oaks are long-lived and lose little value when harvest is postponed, and oak-hickory stands more than 100 years old provide habitat for various cavity nesting birds (Evans and Kirkman 1981). However, oak decline is a serious problem for Missouri's red oaks, especially scarlet oak, and mature to overmature trees may be particularly susceptible.

TIMBERLAND PRODUCTIVITY IS LOW

Site index is a measure of forest site quality based on the height attained by dominant and codominant trees of selected species at 50 years of age. Twenty-four percent (3.3 million acres) of the State's timberland area is classed at site index 70 feet or better. Two percent (299 thousand acres) is classed at site index 90 feet or better. The weighted average site index for all forest types in the State is 62 feet compared to 74, 70, and 63 feet for the neighboring States of Illinois, Iowa, and Kansas, respectively. Among Missouri's oak forest types, the weighted average for black-scarlet oak is 65 feet, followed by white oak (61 feet) and post-blackjack oak (55 feet). Sander (1977) recognized three broad classes for oak site index: indices greater than 75 feet indicate good oak sites, those between 55 and 74 are average, and those below 54 are considered poor. In some regions of the country, it is difficult to perpetuate oak on good sites due to competition from other hardwoods. However, the lack of desirable non-oak timber species in the Ozarks indicates that oak is the species to manage for, even on good sites (Sander 1977), although shortleaf pine may be an alternative where oak decline is causing heavy red oak mortality.

Potential productivity class, another means of characterizing site quality, describes timberland in terms of its inherent capacity to grow wood based on culmination of mean annual increment in fully stocked, natural stands[1]. Potential productivity class values are expressed as cubic feet of growth per acre per year that might be expected under these conditions. An estimated 47 percent (6.3 million acres) of Missouri's timberland is not capable of producing 50 cubic feet per acre per year (fig. 9). Another 48 percent (6.4 million acres) can produce between 50 and 85 cubic feet per acre per year.

[1] *Culmination of mean annual increment is the point at which a curve plotting current annual increment crosses a curve plotting mean annual increment. Culmination of mean annual increment indicates the age at which average annual growth is the greatest, and thus, the rotation age of maximum volume-growth productivity.*

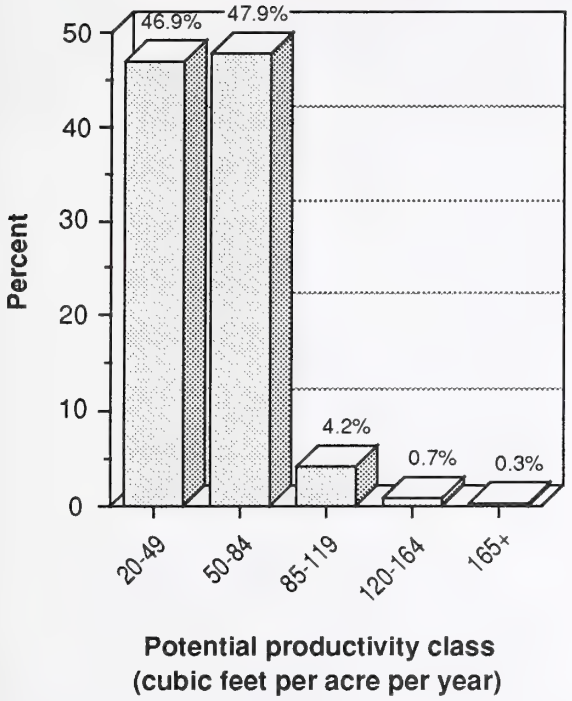


Figure 9.—*Percent timberland area by potential productivity class, Missouri, 1989.*

The weighted average potential productivity class for all forest types in Missouri is 55 cubic feet per acre per year, compared to 81, 57, and 75 for the neighboring States of Illinois, Iowa, and Kansas, respectively. Weighted averages by Survey Unit range from 48 in the Northwest Ozarks, 53 in the Southwest Ozarks, 54 in the Eastern Ozarks, to 57 and 61 in the Riverborder and Prairie Units, respectively, where soils are deeper and more fertile. Potential productivity classes for oak forest types follow the same pattern as site index with a high of 58 cubic feet per acre per year for black-scarlet oak, followed by 53 cubic feet for white oak, and 46 cubic feet for post-blackjack oak.

Only 6 percent (863 thousand acres) of Missouri's timberland area is composed of stands with more than 5,000 board feet[2] per acre. Fifty-five percent (7.3 million acres) contains stand volumes of less than 1,500 board feet per acre. Stand volumes are highest on State-owned timberland where 12 percent of the stands have more than 5,000 board feet per acre.

[2] *International 1/4-inch rule.*

MOST TIMBERLAND IN PRIVATE OWNERSHIP

Eighty-five percent (11.4 million acres) of Missouri's timberland area is in private ownership, primarily private individuals and farmers (fig. 10). More than half (5.9 million acres) of Missouri's privately owned timberland is in parcels smaller than 100 acres. This complicates efforts to encourage forest management on private land. Sixty-two percent of the State's privately owned timberland has been held by the same owner for more than 10 years, and 31 percent has been held for 20 or more years.

There are 2.0 million acres of public-owned timberland in Missouri: 1.6 million acres are Federally owned, 403 thousand are owned by the State, and 42 thousand acres are in county or municipal ownership. Eighty-four percent (1.3 million acres) of Federal timberland in Missouri is in the Mark Twain National Forest, located in the southern and southeastern part of the State. Kingsley and Law (1991) present a detailed analysis of the Mark Twain's forest resource.

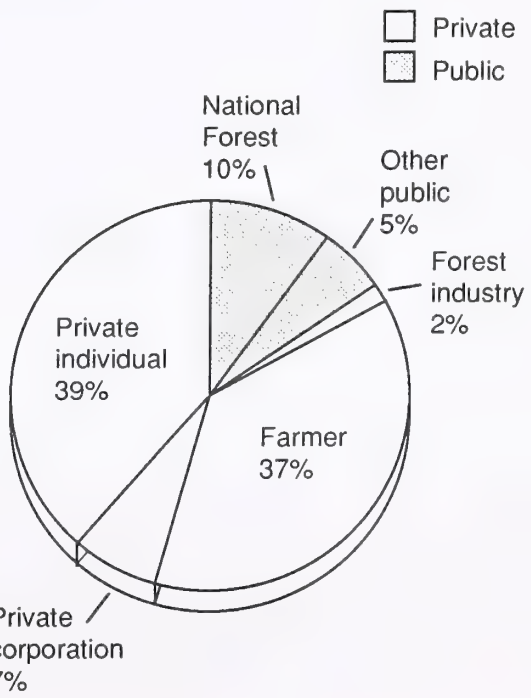


Figure 10.—*Timberland area by ownership class, Missouri, 1989.*

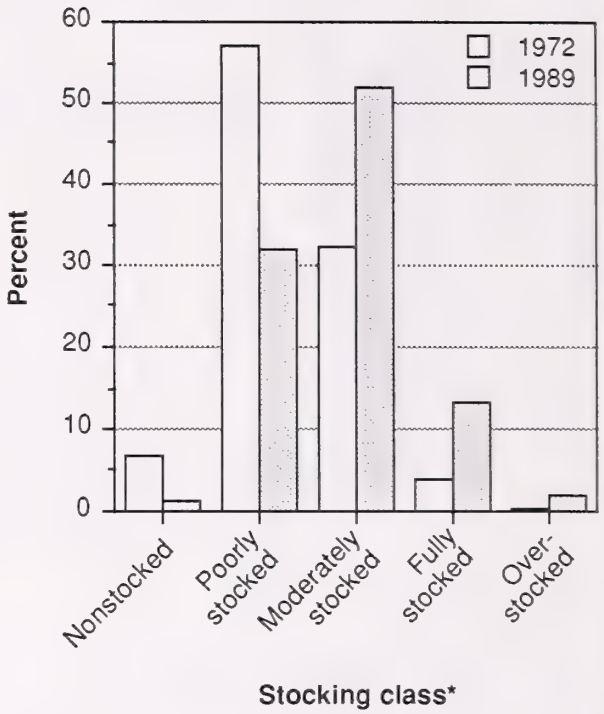
Eighty-three percent of industry-owned, 58 percent of Federally-owned, and 49 percent of State-owned timberland is in the heavily forested Eastern Ozarks Survey Unit (fig. 2). Timberland in other ownership classes is more evenly distributed across Survey Units.

Twenty-three percent (304 thousand acres) of the State's softwood timberland occurs on the Mark Twain National Forest, which represents only 10 percent of Missouri's timberland area. No other ownership group has as much land in softwood forest types. Fifty-seven percent (133 thousand acres) of the State's shortleaf pine timberland area is on the National Forest. Statewide, an understory of shortleaf pine is present on an estimated 649 thousand acres, indicating a potential for expansion of the type. Of this area, 65 percent (422 thousand acres) is currently in oak forest types.

STOCKING HAS IMPROVED

Stocking is a relative measure of tree density on the land and provides a means of describing how fully trees are occupying a site. Sixty-five percent (8.7 million acres) of Missouri's timberland area is moderately or fully stocked with growing-stock trees, and only 2 percent (249 thousand acres) is overstocked (fig. 11). Stocking has improved since the 1972 survey when 64 percent (7.9 million acres) of timberland area was poorly stocked or nonstocked with growing-stock trees. Stocking differs by Survey Unit. In the Prairie Survey Unit 48 percent (1.2 million acres) is poorly stocked or nonstocked; in the Eastern Ozarks Survey Unit, 73 percent (3.0 million acres) of timberland is moderately or fully stocked with 105 thousand acres overstocked.

Eighteen percent (364 thousand acres) of public timberland is poorly stocked or nonstocked with growing-stock trees, compared to 36 percent (4.1 million acres) of privately owned timberland. Thirty-four percent (85 thousand acres) of all overstocked timberland is held by the Mark Twain National Forest, representing about 7 percent of the Forest.



* See Appendix for Definition of Terms.

Figure 11.—*Percent timberland area by stocking class of growing-stock trees, Missouri, 1989.*

The total number of growing-stock trees 5.0 inches in diameter and larger rose from 874 million to 1.1 billion from 1972 to 1989, an increase of 29 percent. The number of hardwood growing-stock trees 5.0 inches in diameter and larger increased from 791 to 984 million (24 percent). Red oaks were up from 269 to 302 million trees (12 percent), while white oaks increased from 323 to 391 million trees (21 percent). The number of softwood growing-stock trees 5.0 inches in diameter and larger increased 75 percent from 82 to 144 million.

PLANTATIONS ARE LESS THAN 1 PERCENT OF TIMBERLAND

An estimated 54 thousand acres are in forest plantations, 65 percent of which were found in the Northwest Ozarks Survey Unit. Seventy-seven percent of plantation acres are in the

shortleaf pine type. Seventy-five percent of the plantation area was planted between 1949 and 1968. Ten percent (5 thousand acres) of plantation area was on land held by private individuals; the remaining 90 percent was on National Forest (32 thousand acres), other Federal (4 thousand acres), and State (13 thousand acres) land.

TIMBER VOLUME MAKES BIG GAINS

The volume of growing-stock on timberland in the State increased from 6.5 to 9.0 billion cubic feet between 1972 and 1989, a 38-percent gain. Sawtimber volume made an even more impressive 52-percent gain, from 17.0 to 25.9 billion board feet.

The 1-million acre gain in timberland area between inventories had little impact on the volume increases. As mentioned earlier, most of the added acres had been classed as wooded pasture (a nonforest land class) in 1972, but livestock grazing had declined by 1989 and tree stocking had improved enough to result in the land being classed as timberland. Because the number and size of trees on this land are small, the timber volume represented by them is also small and could not account for much of the State's volume change. The burgeoning timber volume, then, is the result of a larger average tree size in 1989. Among growing-stock trees, there were more trees and larger timber volumes in each 2-inch diameter class in 1989 than in 1972. This trend towards a larger average tree size is also seen in the expanded area of sawtimber stands, which increased by 1.7 million acres or 36 percent between inventories as poletimber trees grew into sawtimber size.

The Eastern Ozarks Survey Unit had 34 percent of the growing-stock volume (3.1 billion cubic feet), followed by the Riverborder Unit with 19 percent (1.7 billion), the Prairie Unit with 18 percent (1.6 billion), the Southwest Ozarks Unit with 16 percent (1.4 billion), and the Northwest Ozarks Unit with 13 percent (1.2 billion).

Five of the six counties with the largest growing-stock volumes are in the Eastern Ozarks Survey Unit—Shannon (357 million cubic feet), Reynolds (349 million), Wayne (307 million), Washington (274 million), and Iron (231 million). The sixth, Texas (242 million), is in the Southwest Ozarks Survey Unit.

OAKS ACCOUNT FOR TWO-THIRDS OF VOLUME

Of the 9.0 billion cubic feet of growing stock in the State, 8.1 billion cubic feet (90 percent) is in hardwood species. Oak species alone account for 5.9 billion cubic feet. The other red oak group (primarily black oak with much smaller amounts of scarlet, pin, blackjack, shingle, and other oaks) makes up 2.4 billion cubic feet, and the select white oak group (primarily white oak) makes up 2.2 billion cubic feet (fig. 12). The other white oak group (primarily post oak) and the select red oak group (primarily northern red oak) together account for the remaining 1.3 billion cubic feet of oak volume.

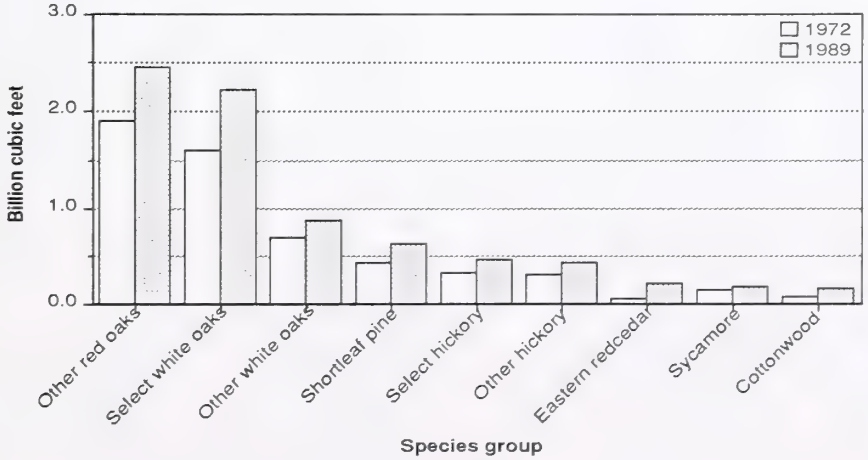


Figure 12.—*Net volume of growing stock on timberland by major species groups, Missouri, 1972 and 1989.*

The ranking of sawtimber volume by species differs somewhat from that of growing stock. Other red oak and select white oak sawtimber volumes also rank first and second, but shortleaf pine, which has the fourth largest growing-stock volume, has the third largest sawtimber volume. Hickory, which ranks third in growing-stock volume, ranks fourth in sawtimber volume.

The 1989 oak volume of 5.9 billion cubic feet is significantly higher than the 1972 oak volume of 4.5 billion cubic feet. However, the oak volume in 1989 makes up only 66 percent of the total growing-stock volume, compared with 69 percent in 1972. Although oak volume is increasing, the volume of other species is increasing faster, as shown by the 31-percent increase between inventories made by the oaks, compared with the 55-percent gain made by other species. Oak decline, the slow growth rates of oaks, and the high demand for oak forest products are some of the reasons the oak volume is not keeping the same pace as other species.

Oak decline, an umbrella term for the effects of several factors that weaken and then kill oaks, is a major reason for the slower increase of oaks. First noticed in the State about 1980 and most common in southeastern Missouri, the decline affects red oaks—primarily scarlet and black oaks—more frequently than white oaks. Oak decline is discussed in more detail later in the section dealing with mortality.

Among the species with the largest volumes, the other white oaks group dropped in ranking between inventories from third in 1972 to fourth in 1989. The group was replaced by hickory, which moved to third in 1989 from fourth in 1972. Growth rates are low for both species, but the rate of removals is nearly twice as high for other white oaks as for hickory.

If only the rate of change in growing-stock volume between inventories is considered, cottonwood clearly made the fastest gain. Its 71.3 million cubic feet in 1972 had swelled to 159.1 million in 1989, a 123-percent increase. Soft maple's 90-percent gain, from 65.0 to 123.6 million cubic feet between inventories, makes it second; the third largest gain was softwoods' 73-percent increase, from 497.3 to 859.4 million. These species will never challenge the supremacy of oaks in Missouri, but they represent a growing and important resource.

NONGROWING-STOCK TREES MAKE IMPORTANT CONTRIBUTIONS

Nongrowing-stock trees contribute non-commodity as well as commodity values to the forest. Rough, rotten, short-log, and salvable dead trees are important as wildlife habitat, are often esthetically pleasing, and encourage biodiversity. These trees provide raw materials for the manufacture of pallets and are also used for forest products such as fuelwood, pulpwood, and posts. In addition to the volume in growing-stock trees mentioned earlier (9.0 billion cubic feet), nongrowing-stock volume adds another 4.9 billion cubic feet (table 5). Most of the latter volume is in rough trees (3.3 billion cubic feet), those that will not yield at least one 12-foot saw log or two saw logs 8 feet or longer because of roughness or poor form. The proportion of rough tree volume to growing-stock tree volume of 37 percent is among the highest in the country, reflecting the harsh sites in many parts of Missouri. It also reflects the many native oak species that are small and poorly formed under average conditions, but that develop even less well under adverse conditions. Nongrowing-stock trees are a much smaller part of the inventory on the Mark Twain National Forest than on land of other owners, attesting to the level of management applied to Forest lands.

Table 5.—*Net volume of growing stock and nongrowing stock on timberland by tree class and by softwoods and hardwoods, Missouri, 1989*
(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Growing stock			
Poletimber	3,654	326	3,328
Sawtimber	5,334	533	4,801
Subtotal	8,988	859	8,129
Nongrowing stock			
Rough trees	3,324	62	3,262
Rotten trees	746	5	741
Short-log trees	787	9	778
Salvable dead trees	72	6	66
Subtotal	4,929	82	4,847
All classes	13,917	941	12,976

VOLUMES IN EVERY DIAMETER CLASS INCREASE

Growing-stock volume is greatest in the 10- and 12-inch diameter classes in 1989, and volumes drop off fairly evenly on either side (fig. 13). Every diameter class has gained substantially in volume since 1972. The biggest proportional increases were made in the larger diameter classes—for example, the 20-inch class showed an 82-percent gain between inventories, but the 8-inch class increased only 23 percent.

The bulk of the softwood volume is in diameter classes 14 inches and smaller. Although the oaks contain the greatest volumes in the larger diameter classes (24 inches and larger), other hardwood species have much greater proportions of their total volume in these classes. The 161 million cubic feet of oaks in classes greater than 24 inches is more than any other species group, but it only amounts to 3 percent of the total oak volume, compared to 88 million cubic feet of cottonwood (55 percent of its total volume), 38 million cubic feet of sycamore (21 percent), and 19 million cubic feet of soft maple (15 percent). This can be partially attributed to the greater demand for oak products than for these other species.

Although most of the volume of a species is usually found in stands of the forest type with which the species is primarily associated, substantial volumes may be found in other types. For example, 31 percent of the shortleaf pine growing-stock volume (195 million cubic feet) is in the oak forest types. Fifty-eight percent of the hard maple volume (39 million cubic feet) is found in oak types, compared to only 40 percent (27 million cubic feet) in the maple-beech type. Some of the hard maple volume in oak types is in older oak stands that are in the process of converting naturally to the maple-beech type. Although 92 percent of the oak volume (5.4 billion cubic feet) is in oak types, 3 percent of the total (157 million cubic feet) is in the shortleaf pine-oak type, and 2 percent (106 million cubic feet) is in the maple-beech type. Most of the black walnut volume (53 percent or 78 million cubic feet) is in the oak types.

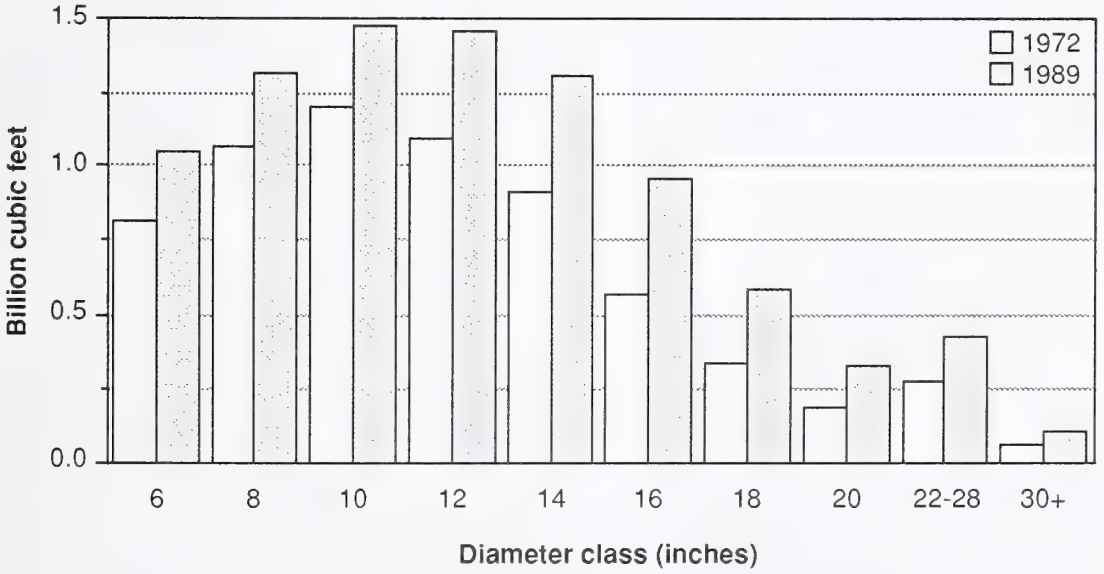


Figure 13.—*Net volume of growing stock on timberland by diameter class, Missouri, 1972 and 1989.*

AGE CLASSES 41 TO 60 YIELD LARGEST VOLUME

Stands aged 41 to 60 years provide 31 percent of the total growing-stock volume, more than any other age class (fig. 14). The area of timberland supporting stands in the 41- to 60-year age class is also the largest, although it represents only 27 percent of the total timberland area. Stands of this age originated during 1929 to 1948, a period of great interest in managing forest lands and in protecting them from fire, disease, and insect loss.

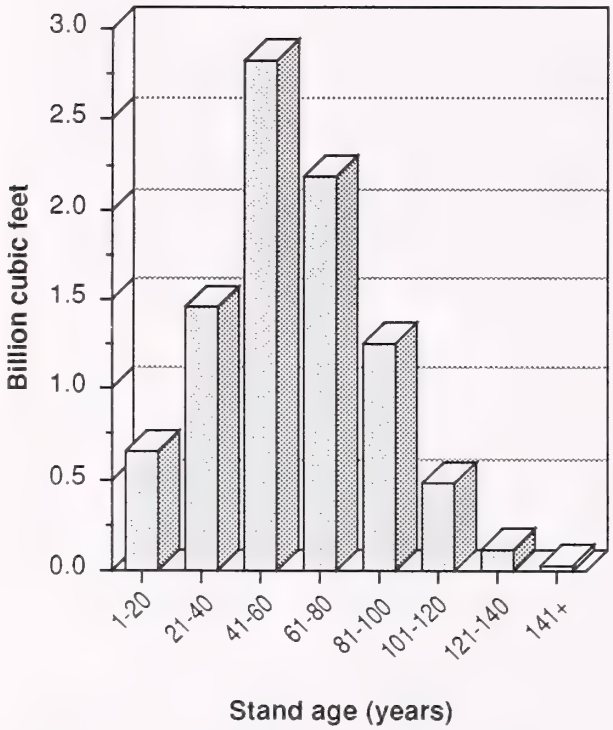


Figure 14.—*Net volume of growing stock on timberland by stand-age class, Missouri, 1989.*

Twelve percent of the growing-stock volume (15 percent of the sawtimber volume) is in stands older than 90 years. Most of this volume is in long-lived oak and maple-beech stands. Therefore, even though these stands are generally considered mature or overmature and may decline in vigor and value, there is little danger of wholesale decay in them.

NONINDUSTRIAL PRIVATE OWNERS HOLD 80 PERCENT OF VOLUME

Miscellaneous private owners account for 4.0 billion cubic feet (44 percent) of the growing-stock volume (fig. 15). Farmers own another 3.2 billion cubic feet (36 percent). Together, these two owner classes comprise the nonindustrial private forest (NIPF) owners in the State. Because there are many NIPF owners, each with different land management interests and objectives, concerted action in addressing Missouri's broad forest management issues is complicated.

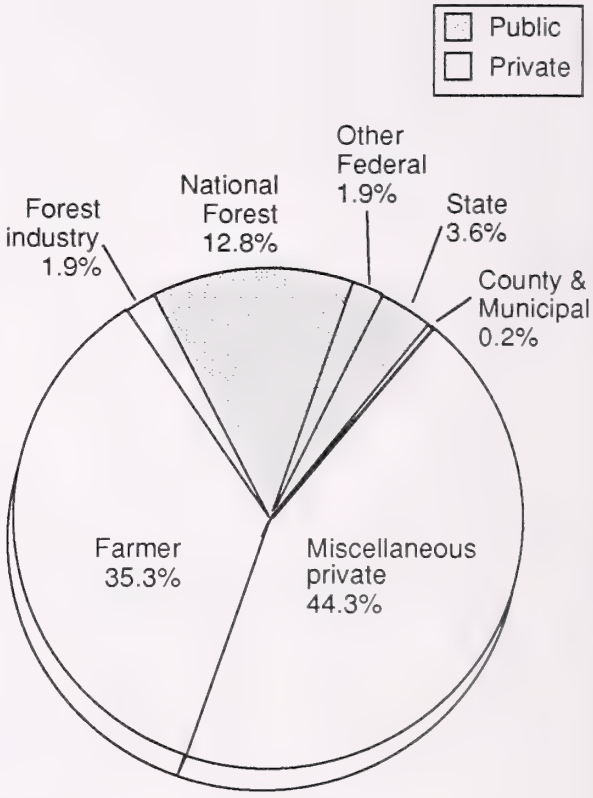


Figure 15.—*Net volume of growing stock on timberland by owner class, Missouri, 1989.*

NIPF owners hold 82 percent of the hardwood growing-stock volume, but only 52 percent of the softwood volume. This reflects the history of greater softwood planting on public lands.

Sixty-four percent of the growing-stock volume and 78 percent of the sawtimber volume are found in sawtimber stands. Poletimber stands

account for 28 percent of the growing-stock volume (16 percent of the sawtimber volume), and sapling-seedling stands contain the remaining 8 percent (6 percent of the sawtimber volume). The latter volumes are primarily from small numbers of big trees scattered throughout sapling-seedling stands. Nonstocked areas provide minimal amounts of the timber volume.

TWENTY-EIGHT PERCENT GAIN IN VOLUME PER ACRE

Average volume per acre of growing stock rose from 526 cubic feet in 1972 to 672 cubic feet in 1989, as the number of growing-stock trees increased between inventories. Also, the weighted average diameter of these trees edged ahead from 8.5 inches in 1972 to 8.6 inches in 1989, as average tree size advanced.

Among owner classes, the highest average volume per acre (871 cubic feet) is on National Forest land, where nearly half of the State's pine volume is located. The lowest average volume per acre (526 cubic feet) is on county and municipal land, much of which is on less productive sites. The cottonwood forest type has the highest average volume per acre (2,233 cubic feet). Although this type, usually found along streams and rivers, covers only a small area (29 thousand acres), individual cottonwood trees grow very large (30 percent of the growing-stock volume of cottonwood is in trees 30 inches in diameter and larger). The shortleaf pine type has the next largest volume per acre (1,251 cubic feet). Lowest volumes per acre are found in the eastern redcedar-hardwood type (368 cubic feet).

QUALITY OF SAWTIMBER IS POOR

Field crews estimated the grade of the butt log of each sawtimber tree on about one-third of the sample plots in the State, to estimate sawtimber quality. In addition, these results were extended to estimate the grade of every log in the sampled tree (whole-tree log grade) by using the findings of a smaller utilization study in which the grade was estimated for each log in the tree of a sample of felled trees on timber sales, and correlated with the butt log grade of the same tree. We then applied the results of this work to the total sawtimber inventory.

Eighty-six percent of the sawtimber volume is in the two poorest butt log grades of the four grades used (fig. 16). Eleven percent of the volume is in butt log grade 2, and the remaining 3 percent is in grade 1. Eighteen percent of the softwood volume is in grades 1 and 2, compared with 14 percent of the hardwood volume.

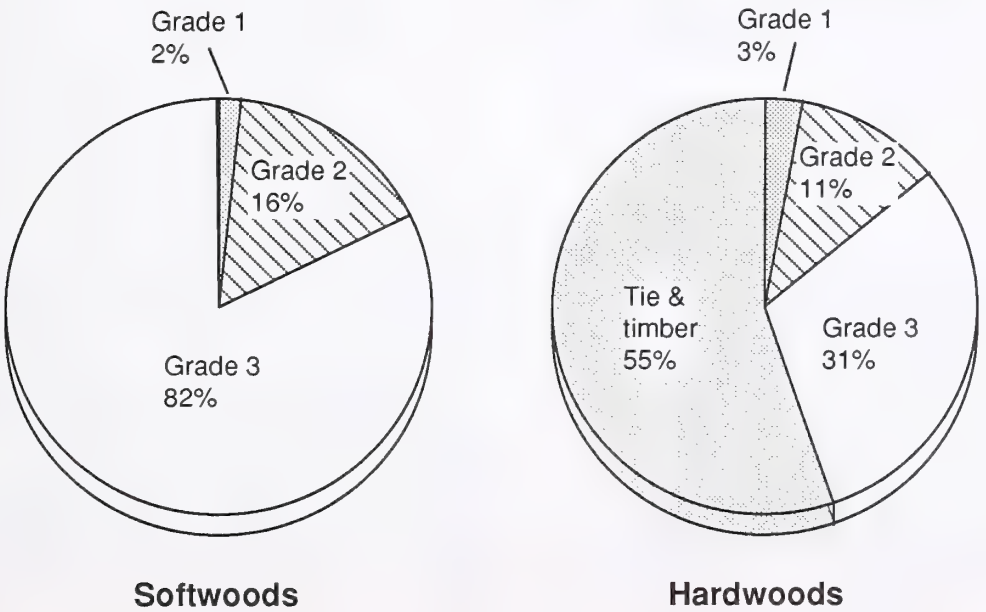


Figure 16.—*Net volume of sawtimber on timberland by butt log grade, Missouri, 1989.*

Estimates of sawtimber volume by whole-tree log grade, as opposed to butt log grade, show that 90 percent is in log grades 3 and 4, the poorest of the four grades used. Slightly more of the softwood volume (93 percent) is in grades 3 and 4 than the hardwood volume (90 percent).

When grading the butt log of hardwood trees on sample plots, field crews also recorded the limiting factor that prevented the log from being graded higher (limiting factors were not recorded for softwoods). This was done to estimate if log grade might improve in the future as trees grow larger. For example, if a butt log could not be given a higher grade because its diameter was too small to qualify for the higher grade, it is possible that the tree's diameter could grow large enough to qualify for the higher grade in the future. Limiting factors include diameter of the tree, length of the butt log, presence of surface defect or knots, sweep or crook of the log, and others. Overwhelmingly, the presence of defect or knots or limbs is the reason logs were not graded higher. Although some knots may become overgrown with clear wood in the future, growth of the tree will not mitigate most of the other factors. Therefore, it seems unlikely that butt log quality will improve much (fig. 17).

About 11 percent of the select red and white oak volume is in log grades 1 and 2, compared with only 5 percent of the other red and white oak volume. Thirteen percent of the select hickory volume, 11 percent of the other hickory volume, and 17 percent of the black walnut volume are in grades 1 and 2.

Included in the 442 million board feet of eastern redcedar in log grade 3 is approximately 46 million board feet in cedar grade 5, a special grade used in Missouri to designate small cedar logs that can be utilized for specialty products such as paneling for closets.

VOLUME OF GROWTH GAINS

The volume of net annual growth of growing stock increased from 157 million cubic feet in 1971 to 267 million during the period 1972 to

Figure 17.—*Surface defects, like the small dead branches and overgrown knots shown here, are the major reasons for poor log quality in the State, suggesting that quality may not improve much in the near future.*

1988, a 71-percent gain. Sawtimber growth rose from 581 million to 1 billion board feet during the same period, a 72-percent increase. The rate of increase for growing-stock growth was practically the same for softwoods (73 percent) as for hardwoods (70 percent), but the rate for sawtimber was slower for softwoods (54 percent) than for hardwoods (75 percent). These hefty increases between inventories reflect the larger average tree size.

The growth rate for growing stock (growth as a percent of inventory) increased from 2.4 percent in 1971 to 3.5 percent in 1972-1988 (the latter rate is based on the average growing-stock inventory between 1972 and 1989). The sawtimber growth rate rose from 3.4 to 4.7 percent during the same period. Another

measure of growth, the volume of growth per acre, showed similar gains. Growing-stock growth averaged 12.7 cubic feet per acre in 1971, but increased to 20.8 cubic feet in 1972-1988 (the latter is based on the average area of timberland between 1972 and 1989). Sawtimber growth per acre rose from 47.1 to 77.8 board feet during the same period.

Growing-stock growth rates are highest in the Southwest (4.4 percent) and Eastern Ozarks (3.6 percent) Survey Units. Lowest rates are in the Prairie (3.0 percent) and Riverborder (2.8 percent) Survey Units. Softwoods (4.4 percent) have somewhat higher growing-stock growth rates than hardwoods (3.4 percent). Among species with substantial growing-stock volumes (at least 100 million cubic feet), eastern redcedar, soft maple, elm, other red oaks, and shortleaf pine all have growth rates higher than the State average (3.5 percent).

POTENTIAL GROWTH ESTIMATED

Potential net annual growth in Missouri is roughly estimated to be 651 million cubic feet, or 49 cubic feet per acre. These figures compare with the 1972-1989 net annual growth of 267 million cubic feet, or 20 cubic feet per acre. We estimated the potential growth on timberland in the State by using potential productivity class data collected during the latest inventory. These data represent the annual volume of growth per acre of fully stocked natural stands at culmination of mean annual increment. We multiplied the area in each productivity class by the midpoint of the range of growth in that class to estimate potential growth in the State. This method yields a potential growth that is somewhat inflated because most stands in the State are not natural (unmanaged or uncut). Spurr and Vaux (1976) discounted an estimate of potential growth for the Nation by 10 percent to adjust for the differences between actual stand conditions and the fully stocked, natural conditions implicit in use of potential productivity data.

Table 6 shows the method used to estimate potential growth on timberland. The unadjusted potential growth of 723 million cubic feet in the table was discounted by 10 percent, in the manner of Spurr and Vaux, resulting in the adjusted 651 million cubic feet mentioned above.

Potential growth can be advanced even higher if intensive forest management techniques, such as thinning, planting genetically superior trees, and releasing crop trees are practiced widely over the State.

MORTALITY MORE THAN DOUBLES

Average annual mortality of growing stock increased from 32.6 million cubic feet in 1971 to 73.7 million cubic feet during the period 1972 to 1988, a 125-percent gain. Oak decline has

Table 6.—*Estimation of potential net annual growth on timberland, Missouri, 1989*

Potential productivity class (Feet³ per acre per year)	Timberland area	Potential net growth per acre	Unadjusted total potential growth	Adjusted total potential growth (discounted 10%)
	Thousand acres	*Feet³per acre year*	*Thousand feet³per year*	
224-165	33.4	194.5	6,496.3	5,846.7
164-120	97.1	142.0	13,788.2	12,409.4
119-85	558.7	102.0	56,987.4	51,288.7
84-50	6,404.8	67.0	429,121.6	386,209.4
49-20	6,276.8	34.5	216,549.6	194,894.6
	13,370.8		722,943.1	650,648.8

taken its toll, and stands have matured and more trees have died between inventories. The mortality rate is 1.0 percent of the average inventory from 1972 to 1989, up from 0.5 percent in 1971. The hardwood mortality rate (1.0 percent) is much higher than the softwood rate (0.5 percent).

Two-thirds of the volume of growing-stock mortality is due to "unknown and other causes" because field crews could not be certain of the primary cause of death of many trees because of the length of time since tree death. Of the 25.4 million cubic feet of mortality for which a cause could be estimated, 41 percent (10.4 million cubic feet) is due to disease—diseases affecting oaks alone accounted for 7.1 million cubic feet. Twenty-six percent of the mortality is due to weather, primarily drought, and 19 percent is caused by suppression. Smaller amounts of mortality are caused by insects, fire, and animals.

OAK DECLINE IS A MAJOR PROBLEM

As mentioned earlier, oak decline is a major cause of mortality of oaks, particularly the red oaks, in Missouri. This complex interaction of environmental stresses and forest pests is a prime reason for the large proportion of mortality classed as "unknown and other." Trees are weakened by stresses such as drought, frost injury, or insect defoliation. Frequent drought years in the early- to mid-1980's, along with severe winters, predisposed trees in the State to attack by forest pests. Weakened trees are then invaded and killed by insects or diseases that cannot successfully attack healthy trees. Other factors, too, perhaps play a role in the complicated situation—affected trees are often mature or overmature, scarlet oak is short-lived and often grows on poor sites, and many of the scarlet oak sites were occupied by shortleaf pine stands before 1900.

The progression of decline may be slow, occurring over several years. The growth of affected trees may be reduced before the onset of physical symptoms—a general and progressive dying back of foliage from the tips of branches; production of chlorotic, dwarfed, and sparse foliage; development of sprouts on the bole and main branches; and premature autumn leaf color and leaf drop (Wargo *et al.* 1983).

Although many forest insects and diseasès are involved in oak decline, two major pests stand out—*Armillaria* root rot (*A. mellea*), a root disease fungus; and the two-lined chestnut borer (*Agrilus bilineatus* (Weber)), a beetle. *Armillaria* is a common forest fungus that lives on stumps and roots of dead trees. It can infect and kill stressed trees by invading the root system through the soil and killing the roots. Much of the large volume of oak mortality in the State due to disease is attributable to *Armillaria* root rot, as well as to oak wilt, a disease caused by the fungus *Ceratocystis fagacearum*. The two-lined chestnut borer attacks the crowns and stems of weakened trees. The larvae bore into the inner bark where they feed while making galleries in the inner bark and outer wood. The meandering and overlapping galleries may block the movement of nutrients to the roots and of water to the crown. Although insects are the primary cause of only an estimated 9 percent of the State's mortality, they contribute to a much greater share of it by weakening trees and predisposing them to attack by other agents. The combined actions of the borer in the stem and the fungus in the roots can bring about rapid decline and death.

Sawtimber mortality averaged 189 million board feet per year from 1972 to 1988, 0.9 percent of the average inventory during the period—up from 76 million board feet in 1971 (0.4 percent of inventory).

TOTAL REMOVALS DOWN BUT PRODUCTS OUTPUT UP

Total annual timber removals from growing stock in 1987 amounted to 136 million cubic feet, 19 percent less than the 1971 removals of 168 million cubic feet. Softwood removals increased from 8.3 to 11.6 million cubic feet between the 2 years. Hardwood removals fell

from 159 million cubic feet in 1971 to 124 million in 1987, a 22-percent decline. However, total removals, which is not synonymous with total harvest, is composed of three elements: roundwood products (saw logs, veneer logs, pulpwood, etc.), logging residues, and other removals. Other removals includes, among other things, growing-stock trees removed but not used for forest products, such as might occur in land clearing operations. Before the 1972 inventory, large blocks of bottomland hardwoods adjoining rivers and streams were cleared for agricultural purposes. The unutilized timber on these lands was included with other removals in the 1971 estimate of timber removals, and made up 47 percent of the total removals (roundwood products accounted for 44 percent and logging residues made up 9 percent). In 1987 other removals comprised only 21 percent of the total growing-stock removals, roundwood products accounted for 65 percent, and logging residues made up the remaining 14 percent. Roundwood products, then, rose from 75 million cubic feet in 1971 to 89 million in 1987 (fig. 18).

Hardwoods made up 124 million cubic feet (91 percent) of the total growing-stock removals for 1987—red oaks alone accounted for 62 million and white oaks accounted for 36 million. Of roundwood products, saw logs ranked first with 75 million cubic feet (85 percent), and fuelwood ranked second with 7 million cubic feet (8 percent).

Figure 18.—*Roundwood products, like the saw logs being skidded to a landing in the woods, are only one of three components of total timber removals. Logging residues and other removals are the others.*

In addition to the removals from growing stock discussed above, an estimated 18 million cubic feet of nongrowing stock (mostly short-log and rough trees) was harvested in 1987. Much of this volume was in logs hauled to scragg mills to produce pallet parts.

Sawtimber removals in 1987 totaled 492 million board feet, compared with 542 million in 1971. Other removals for sawtimber in 1971, though, amounted to more than double the 1987 volume. If only roundwood products are compared, the 404 million board feet harvested in 1987 exceeded the 341 million cut in 1971.

Because timber removals may fluctuate from year to year, depending on broad economic conditions, the reader may wish to consider average annual removals for the period since the previous inventory, rather than the removals for a single year. Removals for the reported year may have been exceptionally high or low. Average annual removals of growing stock for 1972-1988 were 117 million cubic feet, compared with the 136 million cubic feet reported for 1987 and the 168 million cubic feet for 1971.

Average annual growing-stock removals were 44 percent of the average annual growth for 1972-1988. Average growth was greater than average removals for every species during 1972-1988 (fig. 19). Species with removals closest to growth are cottonwood (removals 74 percent of growth), tupelo (74 percent), and other white oaks (67 percent). Average annual removals of sawtimber for 1972-1988 were 409 million board feet, compared with 492 million reported for 1987 and 542 million reported for 1971. Average annual removals of sawtimber amounted to 41 percent of average annual sawtimber growth for 1972-1988.

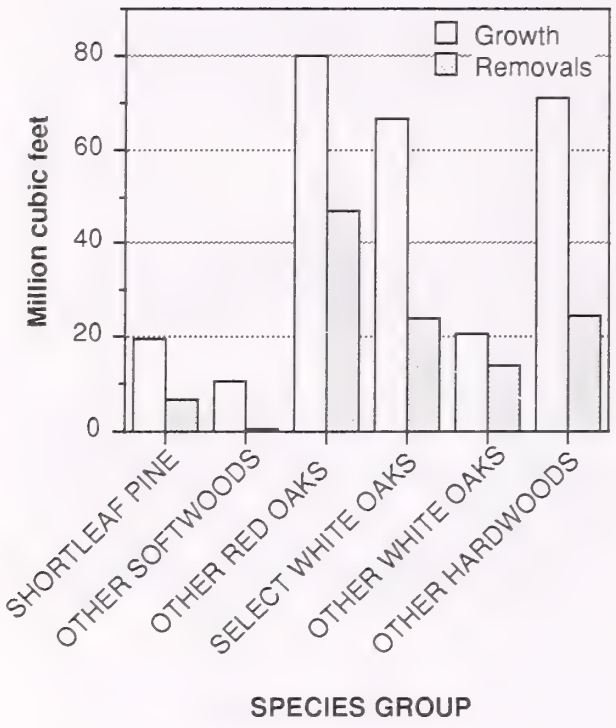


Figure 19.—*Average net annual growth and average annual removals of growing stock on timberland, Missouri, 1972-1988.*

BIOMASS ESTIMATED

During the 1989 inventory, we estimated the aboveground weight (biomass) of live trees and shrubs in the State. This kind of information is important to those who need to know about the total vegetation on the ground. Data on the frequency of plants in the forest are invaluable to those grappling with questions of plant diversity in the State, as well as to wildlife biologists and ecologists. As technology permits new ways of using plant fiber, it becomes more important to know how much of which plants are present.

The total biomass of all live trees at least 1 inch d.b.h. on timberland in Missouri was 850 million green tons in 1989, averaging 64 tons per acre. The oak forest types (post-blackjack, black-scarlet, and white oak) accounted for 79 percent of the biomass—669 million tons—averaging 65 tons per acre. The maple-beech type contains the next largest biomass, 51 million tons (52 tons per acre); followed by elm-ash-soft maple, 44 million tons (74 tons per acre); shortleaf pine-oak, 25 million tons (68 tons per acre); and eastern redcedar-hardwood, 23 million tons (47 tons per acre). Although the cottonwood forest type contains the smallest total biomass—4 million tons—it represents the greatest per acre biomass—122 tons per acre.

The largest share of the live tree biomass (37 percent) is in the boles of growing-stock trees, as shown in the following tabulation:

Biomass component	Weight (Million green tons)	Percent
Growing-stock trees		
Stumps	29.1	3
Boles	310.9	37
Tops and limbs	94.8	11
Nongrowing-stock trees		
Stumps	19.6	2
Boles	217.7	26
Tops and limbs	65.3	8
Live 1- to 5-inch trees	113.1	13
Total	850.5	100

The largest shrub biomass is in the elm-ash-soft maple type (3,375 pounds per acre green weight), followed by the maple-beech type (2,248 pounds per acre) and the eastern redcedar-hardwood type (2,064 pounds per acre). Shrub biomass includes the biomass of live tree seedlings less than 1 inch d.b.h., tall shrubs, and low shrubs. The bulk of the shrub biomass is in tree seedlings. For example, of the above 3,375 pounds per acre of shrub biomass in the elm-ash-soft maple type, 2,775 pounds are in tree seedlings, 428 pounds are in tall shrubs, and 172 pounds are in low shrubs.

Among species of tree seedlings, elm produced the greatest average biomass (199 pounds per acre green weight)[3], followed by other red oaks (130 pounds per acre). Sumac, among tall

[3] *A weighted average based on the number of plots sampled in each forest type and the biomass of each species in the type, including types in which the shrub species was not found.*

shrubs, generated the largest biomass (121 pounds per acre), and Virginia creeper produced the greatest biomass of the low shrubs (57 pounds per acre).

TIMBER SUPPLY EXPANSION PROJECTED TO CONTINUE

To get a perspective of the future timber resource of the State and to better understand Missouri's role in helping to provide for the Nation's timber needs, we made two sets of 30-year projections of the State's timber situation. One projection assumes a continuation of recent levels of timber removals (low removals option), and the other assumes an accelerated level of timber removals (high removals option). Separate projections were made for softwoods and for hardwoods.

Assumptions used in making the projections are: (1) the total area of timberland will decline an average of 0.012 percent per year between 1989 and 2019, from 13,371 to 13,323 thousand acres; (2) the intensity of management will continue at the rate indicated by recent trends for the low removals option; but intensified management will permit high risk trees to be harvested before they die, thus reducing mortality rates, for the high removals option; (3) the volume of other removals will drop during the period as more of these trees are utilized for products; (4) growth rates will remain close to the 1988 rates (3.5 percent of inventory for softwoods and 2.9 percent for hardwoods); and (5) there will be no major changes in the economic, social, or political structure.

Low Removals Option Projection

In the low removals option projection for growing stock, timber removals rise continuously from 136 million cubic feet in 1988 to 213 million cubic feet in 2019, an increase of 57 percent. Growth remains higher than removals during the projection period, and the difference between growth and removals increases slightly each year. Inventory increases throughout the period, but at a slightly lower rate each year (fig. 20).

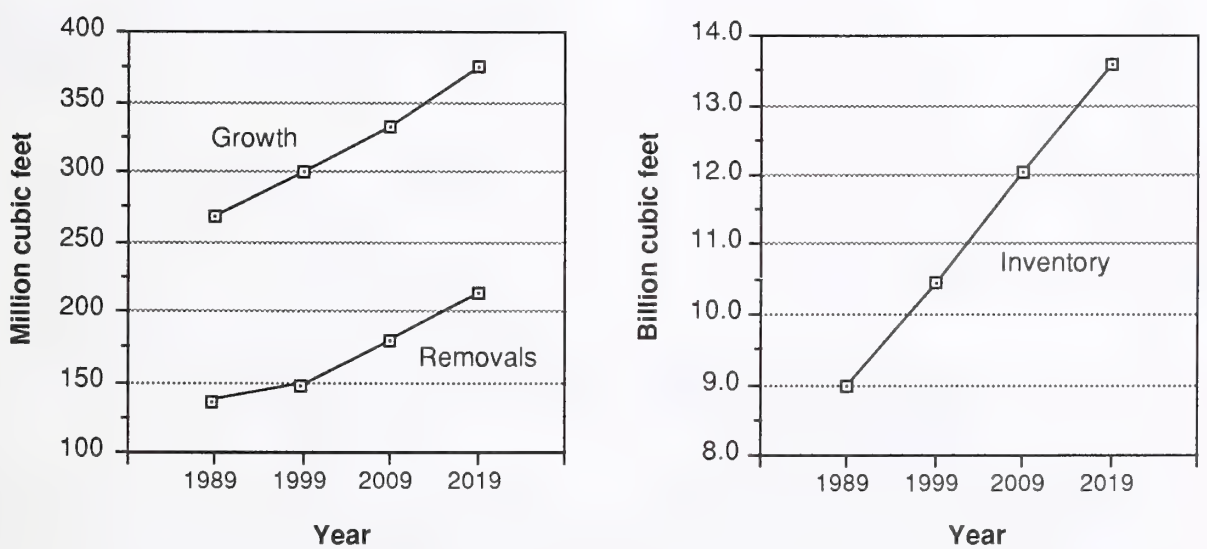


Figure 20.—*Removals, net annual growth, and inventory of growing stock on timberland, Missouri, 1989, and low removals option projections to 2019.*

The low option assumes that average annual softwood removals will increase faster than hardwood removals. Removals of softwoods are projected to increase 115 percent between 1989 and 2019, compared to 51 percent for hardwoods. Most of the increase will probably be in the shortleaf pine-oak and shortleaf pine forest types.

The 267 million cubic feet of net annual growth in 1989 is projected to increase to 376 million by 2019, a gain of 40 percent. Softwood growth is projected to increase 59 percent during the period, and hardwood growth is projected to gain 38 percent.

The 1989 growing-stock inventory of 9.0 billion cubic feet is projected to rise to 13.6 billion in 2019, a 51-percent gain. The rate of increase is almost equal in each decade of the projection period. Softwood inventory expands faster than hardwood inventory—a 69-percent increase over the 30-year period, compared with a 49-percent increase for hardwoods. Growing-stock volume is expected to increase fastest in the eastern redcedar forest type, the eastern redcedar-hardwood type, the maple-beech type, and the post-blackjack oak type.

High Removals Option Projection

The high removals option projection shows larger timber removals than for the low removals option, increasing at about the same rate during each decade. Removals expand from 136 million cubic feet in 1989 to 266 million in 2019, a 96-percent increase. Growth remains greater than removals throughout the 30-year period, but approaches closer to removals each decade, with growth exceeding removals by only 65 million cubic feet in 2019, compared to 131 million in 1989. Inventory of growing stock enlarges, but at a slower rate each decade, from 9.0 billion cubic feet in 1989 to 12.0 billion in 2019 (fig. 21).

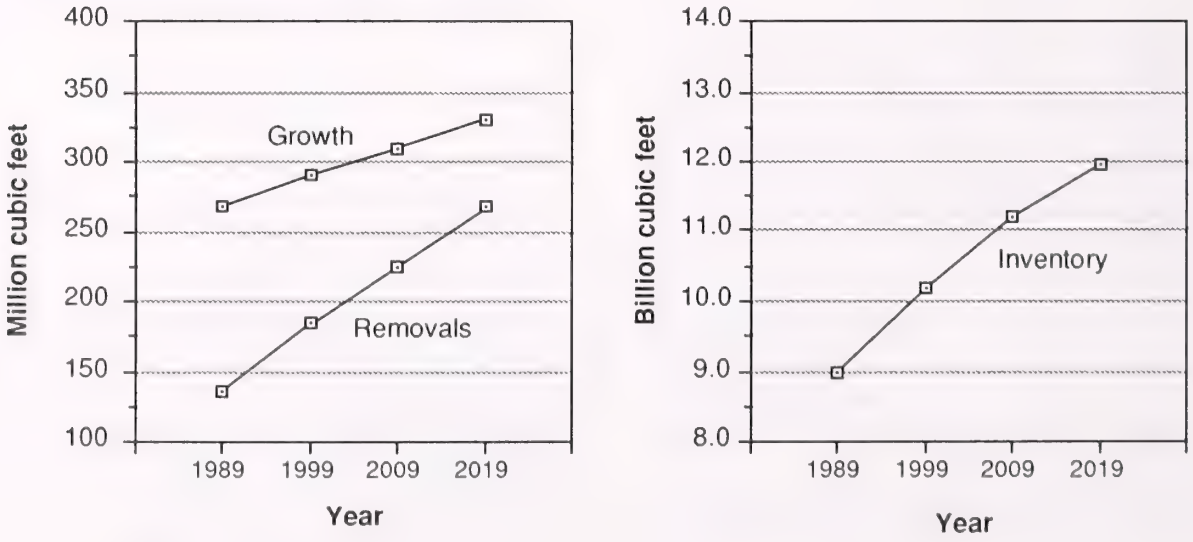


Figure 21.—*Removals, net annual growth, and inventory of growing stock on timberland, Missouri, 1989, and high removals option projections to 2019.*

This option assumes that removals for softwoods will increase faster than for hardwoods during the 30-year period—163 percent and 90 percent, respectively. Big increases in removals might be expected for the maple-beech, shortleaf pine-oak, shortleaf pine, and elm-ash-soft maple forest types by 2019 (fig. 22). The net annual growth of 267 million cubic feet in 1989 is projected to rise to 331 million by 2019, a modest 24-percent gain. Growth on softwoods is projected to increase faster than hardwood growth—43 percent and 21 percent, respectively.

Figure 22.—*Land managers will need to ensure that the expected future accelerated demand for oak can be met without degrading the oak resource.*

The growing-stock inventory of 9.0 billion cubic feet in 1989 is projected to expand to 12.0 billion in 2019, a 33-percent rise. The rate of increase slows with each succeeding decade as growth converges with removals. The softwood inventory advances 52 percent over the 30-year period, but hardwoods gain only 31 percent.

THE OUTLOOK

The two sets of projections offered represent the forest situation over the next 30 years only if the future plays out in the same sequence as the assumptions suggest. The projections, then, probably establish the high and low limits of the future forest. Projections made for the first decade are more dependable than those for the last two decades because economic and market conditions can change quickly, making long range projections less reliable.

The inventory of growing stock will likely continue to expand to 2019, although the softwood inventory will rise much faster than the inventory of hardwoods due to slightly higher growth rates. However, softwoods will remain subordinate to hardwoods, making up 10 percent of the growing-stock volume in 1989 and a projected 11 percent of it in 2019. Inventories can be extended further by increased use of residues, tree tops, and limbs, the volumes of which are not included in growing-stock inventories, and by greater use of short-log, rough or rotten trees, which are part of the nongrowing-stock resource. Substantially intensified forest management applied throughout the period could help to bring about larger inventories than those projected. The response of public land management agencies to increasing demands by the public to modify timber harvesting practices will certainly have an impact on inventory levels.

Oaks will dominate the forest in 2019 as they did in 1989. However, inventories of eastern redcedar, red maple, and sugar maple, although comparatively small, are expanding, and new ways must be found to use these traditionally little-used resources. The future of the shortleaf pine resource, about half of which is on the Mark Twain National Forest, is more difficult to predict. Pine inventories are increasing, but the future level of harvest, and thus the future level of inventory, on the Mark Twain is uncertain because of public pressures to curtail logging on National Forests.

The future impact of oak decline on the vital oak resource is also difficult to predict. If periods of drought occur and give rise to conditions that allow weakening and death of trees from a host of forest pests over an extended time, the toll on oaks could be substantial. This, in turn, could generate further increases in the maple-beech forest type as the opportunistic, shade tolerant species in this type claim ravaged oak sites.

The already high demand for oak, especially red oak, will probably climb even higher in the future. Some industry forecasts show large future increases in demand for oak with part of this demand coming from Europe. Much of the demand will be for large diameter, high quality logs. Land managers will need to ensure that this demand can be met without degrading the oak resource. Although there was a sizable excess of growth over removals in all oak species groups in 1972-1988, some of the growth volume was on trees not of merchantable size. Therefore, a simple comparison of growth and removals may not provide an accurate indication of whether the resource is being overutilized.

As demand for oak increases, and as stumpage prices for oak rise accordingly, the search will intensify for substitutes for high priced oak products. Some less expensive soft hardwoods such as soft maple, sycamore, yellow-poplar, and elm may provide acceptable alternatives. (Hard maple may be another possibility among hard hardwoods.) If this occurs, formerly sluggish markets for these species may grow, requiring intensified management of the elm-ash-soft maple forest type, which generally occurs on moist sites and in riparian areas.

Other pressures, too, will shape the future forests of Missouri. The increasing awareness and concern of the public about environmental issues will translate into changing land management practices, especially on public lands. The desire for ecosystem-sensitive management will lead to management strategies that are "easier on the land." The public demand to protect old growth forests may result in much-lengthened rotations for some stands over 100 years old. Non-commodity products from the forest—recreation, wildlife, and clean water—will become increasingly vital. The level of timber available for future harvest in the State will depend greatly on the often conflicting goals of environmental interests and industry interests.

LITERATURE CITED

Allen, Arthur W.; Corn, Janelle G. 1990. **Relationships between live tree diameter and cavity abundance in a Missouri oak-hickory forest.** Northern Journal of Applied Forestry. 7(4): 179-183.

Dellinger, George P. 1973. **Habitat management for turkeys in the oak-hickory forests of Missouri.** In: Sanderson, Glen C.; Schultz, Helen C., eds. Wild turkey management: current problems and programs. 2d National wild turkey symposium; 1970 February 10-12; Columbia, MO. Columbia, MO: The Missouri Chapter of the Wildlife Society and the University of Missouri Press: 235-244.

Evans, Keith E.; Kirkman, Roger L. 1981. **Guide to bird habitats of the Ozark Plateau.** Gen. Tech. Rep. NC-68. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 79 p.

Gansner, David A. 1965. **Missouri's forests.** Resour. Bull. CS-2. Columbus, OH: U.S. Department of Agriculture, Forest Service, Central States Forest Experiment Station. 53 p.

Goodrum, P.D.; Reid,V.H.; Boyd, C.E. 1971. **Acorn yield, characteristics, and management criteria of oaks for wildlife.** Journal of Wildlife Management. 35(3): 520-532.

Hahn, Jerold T.; Hansen, Mark H. 1991. **Cubic and board foot volume models for the Central States.** Northern Journal of Applied Forestry. 8(2): 47-57.

Hahn, Jerold T.; Spencer, John S., Jr. 1991. **Timber resource of Missouri, statistical report, 1989.** Resour. Bull. NC-119. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 123 p.

King, D.B.; Roberts, E.V.; Winters, R.K. 1949. **Forest resources and industries of Missouri.** Res. Bull. 452. Columbia, MO: University of Missouri, College of Agriculture, Agricultural Experiment Station. 89 p.

Kingsley, Neal P.; Law, Jay R. 1991. **Timber Resource of the Mark Twain National Forest.** Resour. Bull. NC-129. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 31 p.

Kubisiak, John F. 1991. **Regional concerns for wild turkey and ruffed grouse management.** In: Laursen, Steven B.; DeBoe, Joyce F., eds. The oak resource in the upper midwest: implications for management conference; 1991 June 3-6; Winona, MN. Publ. NR-BU-5663-S. St. Paul, MN: Minnesota Extension Service: 83-91.

Lawson, Edwin R.; Law, Jay R. 1983. **Eastern redcedar.** In: Burns, Russell M., ed. Silvicultural systems for the major forest types of the United States. Agric. Handb. 445. Washington, DC: U.S. Department of Agriculture, Forest Service: 109-112.

Little, Elbert L. 1979. **Checklist of native and naturalized trees of the United States.** Agric. Handb. 541. Washington, DC: U.S. Department of Agriculture, Forest Service. 375 p.

Loetsch, F.; Haller, K.E. 1964. **Forest inventory, volume 1, Statistics of forest inventory and information from aerial photographs.** Vienna: BLV Verlagsgesellschaft Munch Basle. 436 p.

Rast, Everette D.; Sonderman, David L.; Gammon, Glenn L. 1973. **A guide to hardwood log grading.** Gen. Tech. Rep. NE-1. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 31 p.

Sander, Ivan L. 1977. **Oaks in the North Central States.** Gen. Tech. Rep. NC-37. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 35 p.

Shaw, Samuel P. 1971. **Wildlife and oak management.** In: Oak symposium proceedings; 1971 August 16-20; Morgantown, WV. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 84-89.

Shifley, Stephen R. 1987. **A generalized system of models forecasting Central States tree growth.** Res. Pap. NC-279. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 10 p.

Smith, W. Brad. 1985. **Adjusting the STEMS regional growth models to improve local predictions.** Res. Note NC-297. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5 p.

Smith, W. Brad. 1985. **Factors and equations to estimate forest biomass in the North Central Regions.** Res. Pap. NC-268. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 6 p.

Smith, W. Brad; Jones, Shelby. 1990. **Missouri timber industry—an assessment of timber product output and use.** Resour. Bull. NC-120. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 51 p.

Spencer, John S., Jr.; Essex, Burton L. 1976. **Timber in Missouri, 1972.** Resour. Bull. NC-30. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 108 p.

Spurr, Stephen H.; Vaux, Henry J. 1976. **Timber: biological and economic potential.** Science. 191(4228): 751-756.

Wargo, Philip M.; Houston, David R.; LaMadeleine, Leon A. 1983. **Oak decline.** For. Insect and Dis. Leafl. 165. Washington, DC: U.S. Department of Agriculture, Forest Service. 8 p.

Wiant, Harry V., Jr.; Castenaeda, Froylan. 1977. **Mesavage and Girard's volume tables formulated.** BLM4. Denver, CO: U.S. Department of Interior, Bureau of Land Management, Denver Service Center: 1-4.

Yoakam, Jim; Dasmann, William P.; Sanderson, H. Reed; Nixon, Charles M.; Crawford, Hewlette S. 1980. **Habitat improvement techniques.** In: Schemnitz, Sanford D., ed. Wildlife management techniques manual. Washington, DC: The Wildlife Society: 329-403.

APPENDIX

ACCURACY OF THE SURVEY

Forest Inventory and Analysis information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. A measure of reliability of these figures is given by sampling errors. These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated.

For example, the estimated growing-stock volume in the State in 1989, 8,988.6 million cubic feet, has a sampling error of ± 1.04 percent (± 93.5 million cubic feet). The growing-stock volume from a 100-percent inventory would be expected to fall between 8,895.1 and 9,082.1 million cubic feet (8,988.6 ± 93.5), there being a one in three chance that this is not the case.

The following tabulation shows the sampling errors for the 1989 Missouri Forest Inventory:

Item	State totals	Sampling error
Growing stock	(Million cubic feet)	(Percent)
Volume (1989)	8,988.6	1.04
Average net annual growth (1972-1988)	267.3	1.57
Average annual removals (1972-1988)	116.6	6.34
Sawtimber	(Million board feet)	
Volume (1989)	25,883.6	1.48
Average net annual growth (1972-1988)	1,000.4	2.00
Average annual removals (1972-1988)	408.7	7.86
Timberland area (1989)	(Thousand acres) 13,370.8	0.53

As survey data are broken down into sections smaller than State totals, the sampling error increases. For example, the sampling error for timberland area in a particular county is higher than that for total timberland area in the State. The previous tabulation shows the sampling errors for State totals. To use this information for data smaller than State totals, use the following formula to compute error estimates:

$$E = \frac{(SE)\ \sqrt{\text{(State total area or volume)}}}{\sqrt{\text{(Volume or area smaller than State total)}}}$$

where:

E = sampling error in percent
SE = Unit total error for area or volume

For example, to compute the error on the area of timberland in the black-scarlet oak type in the State, proceed as follows:

The area of black-scarlet oak type in the State from table 10 = 4,912,200 acres.

The area of all timberland in the State from table 10 = 13,370,800 acres.

The error for State total timberland area from the above tabulation = 0.53 percent.

Using the above formula:

$$\text{Error} = \frac{(0.53)\ \sqrt{13{,}370{,}800}}{\sqrt{4{,}912{,}200}}$$

$$= \pm 0.87 \text{ percent}$$

The error for black-scarlet type in the State = 0.87 percent.

SURVEY PROCEDURES

The 1989 Missouri survey used a growth model enhanced two-phase sample design. This sampling scheme and associated estimators are similar to sampling with partial replacement (SPR) in that a set of randomly located plots is available for remeasurement and a random set of new plots is established and measured. A significant feature of this design is stratification for disturbance on the old sample and use of a growth model to improve regression estimates made on undisturbed forest plots from the previous inventory (fig. 23). The growth model used in the Missouri survey design was the Central States Stand and Tree Evaluation and Modeling System (STEMS) (Shifley 1987).

The major steps in the 1989 Missouri forest inventory were as follows:

1. Aerial photography (Phase 1)

In this phase two sets of random points were located on current aerial photography. The first is a set of new photo plots and the second is a set of relocated ground plot locations from the previous inventory. Photos were 1:20,000 and 1:40,000, scale, black and white panchromatic prints provided by the Agricultural Stabilization and Conservation Service (ASCS) and the Missouri Department of Natural Resources, Geology and Land Survey.

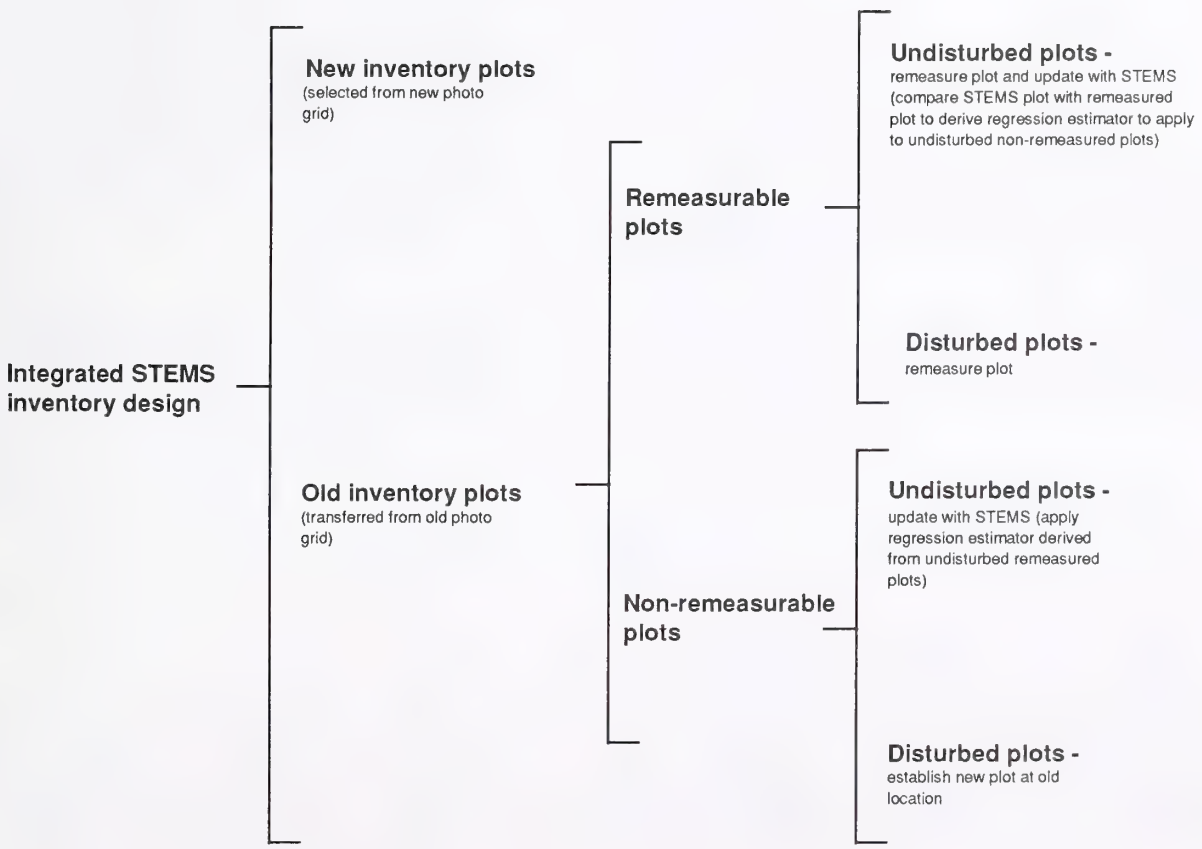

Integrated STEMS inventory design
New inventory plots
(selected from new photo grid)
Old inventory plots
(transferred from old photo grid)
Remeasurable plots
Non-remeasurable plots
Undisturbed plots -
remeasure plot and update with STEMS (compare STEMS plot with remeasured plot to derive regression estimator to apply to undisturbed non-remeasured plots)
Disturbed plots -
remeasure plot
Undisturbed plots -
update with STEMS (apply regression estimator derived from undisturbed remeasured plots)
Disturbed plots -
establish new plot at old location

Figure 23.—*Overview of the Missouri sample design.*

The locations of the plots used in the 1972 Missouri inventory were transferred to these new photographs. The photographs were then assembled into township mosaics, and a systematic grid of 121 one-acre photo plots, each plot representing approximately 190.4 acres, was overlaid on each township mosaic. Each of these plots, both the new systematic grid points and the old sample plots, was examined by aerial photogrammetrists and classified by land use. If trees were present, forest type and stand size-density class were also recorded. Then all the old sample locations and a sample of the new photo plots were sent to the field for verification of the photo classification and for more detailed measurement. A total of 235,887 photo plots (10,536 old and 225,351 new) were examined stereoscopically as shown in the tabulation at the bottom of this page.

2. Plot measurements (Phase 2)

On plots sent to the field classified as timberland, wooded pasture, or windbreak (at least 120 feet wide), a ground plot was established, remeasured, or modelled. Ground plots consist of a 10-point cluster covering approximately 1 acre. At each point, trees 5.0 inches or more in d.b.h. were sampled on a 37.5 Basal Area Factor (BAF) prism on a variable-radius plot, and trees less than 5.0 inches d.b.h. were sampled on a 1/300-acre fixed-radius plot.

From the new photo plots, a random sample of ground plots was established and measures of land use, volume, mortality and cutting were recorded. These locations were monumented for future remeasurement. The procedures for the old inventory photo plots (old plot locations) were somewhat different. Old plots were classed as remeasurable (monumented) or nonremeasurable (not monumented and thus difficult to relocate in the field). Within both of these groups, old plots can additionally be identified as undisturbed or disturbed. Ground plots corresponding to remeasurable old inventory photo plots that were classified as undisturbed forest land were remeasured to obtain current land use, volume, growth, and removals information.

All undisturbed remeasurable forest plots were projected to the current time using STEMS, which yields projected estimates of current volume and growth. The comparison of the projected and observed values for these plots provided local calibration data to adjust the projected values of the undisturbed nonremeasurable plots. The adjustment procedure is described by Smith (1985) in a separate publication. All disturbed remeasurable plots were remeasured on the ground to assess changes since the last inventory. Disturbance refers to any change on a plot that can be detected on aerial photos and that the STEMS growth processor cannot predict, such as catastrophic mortality, cutting, growth of seedling stands, and land use change.

Temporary forest plots that were not monumented during the 1972 inventory, play a crucial role in the new survey design. These points were carefully examined, comparing past

Photo land class	State total	Eastern Ozarks	Southwest Ozarks	Northwest Ozarks	Prairie	Riverborder
Timberland	75,709	22,095	14,458	12,546	14,482	12,128
Reserved timberland	1,501	766	263	123	70	279
Questionable	1,897	513	720	380	232	52
Nonforest with trees	8,584	1,073	1,577	1,535	3,370	1,029
Nonforest without trees	145,771	7,791	12,193	12,301	84,229	29,257
Water	2,425	132	314	626	687	666
All classes	235,887	32,370	29,525	27,511	103,070	43,411

and current aerial photography to determine which plots were undisturbed and had conditions that could be simulated by STEMS. For those plots that could be updated, past and current photography was examined to determine that only normal growth and mortality had occurred. STEMS was then used to "grow" the old plot and tree data to develop the current estimate. Thus, these plots were treated as ground plots, even though they were never visited. The plot record for each updated plot was sent to the field for verification of current ownership information. For points the field crew was unable to relocate, that were classified as disturbed, a new ground plot was established as close to the old location as possible. This allows information about land use trends to be recorded even though it may not be possible to locate the old plot exactly.

The estimation procedure for computing statistics from this sampling design was more complicated than the simple two-phase estimation procedure used in the past. In fact, this procedure yielded two independent samples, one coming from the new photo points and the other coming from the old photo points that are remeasured or updated. Table 7 summarizes the distribution of ground plots for the new inventory design.

3. Area estimates

Area estimates were made using two-phase estimation methods. In this type of estimation, a preliminary estimate of area by land use is made from the aerial photographs (Phase 1) and corrected by the plot measurements (Phase 2). A complete description of this estimation method is presented by Loetsch and Haller (1964).

4. Volume estimates

Estimates of volume per acre were made from the trees measured or modelled on the 10-point plots. Estimates of volume per acre were multiplied by the area estimates to obtain estimates of total volume. Net cubic foot volumes are based on equations developed by Hahn and Hansen (1989) for use in the Central States. Biomass estimates are based on equations developed by Smith (1985).

The Forest Service reports all board foot volume in International 1/4-inch rule. In Missouri, the Doyle log rule is commonly used. Doyle log rule conversion factors were derived from full tree measurements taken throughout the Central States (Illinois, Indiana, Iowa, and Missouri) and an equation developed by Wiant and Castenaeda (1977). The factors (multipliers) for converting board foot International volumes to the Doyle rule are shown in the following tabulation:

D.b.h. (inches)	Doyle rule conversion factor	
	Softwoods	Hardwoods
9.0-10.9	0.3455	—
11.0-12.9	0.4780	0.4172
13.0-14.9	0.5992	0.5118
15.0-16.9	0.6908	0.5882
17.0-18.9	0.7685	0.6569
19.0-20.9	0.8573	0.7180
21.0-22.9	0.8645	0.7829
23.0-24.9	0.9276	0.8324
25.0-26.9	0.9493	0.8736
27.0-28.9	0.9710	0.9473
29.0+	1.1065	1.1349

5. Growth and mortality estimates

On remeasured plots, estimates of growth and mortality per acre come from the remeasured diameters of trees and from observation of trees that died between inventories. Growth is reported for 1988, the last year before the inventory, and is based on an assumption of constant basal area growth over the remeasurement period. Mortality is reported for 1988 also, and is based on an assumption of constant volume mortality over the remeasurement period. On new plots, where trees were not remeasured, estimates of growth and mortality were obtained by using STEMS to project the growth and mortality of trees for 1 year. Growth and mortality estimates for old undisturbed plots that were updated were derived in the same manner as remeasured plots. The STEMS growth model was adjusted by Survey Unit to meet local conditions. As with volume, total growth and mortality estimates were obtained by multiplying the per acre estimates by area estimates.

Table 7.—*Number of ground plots by ground land use class and sample class, Missouri, 1989*

Ground land use class	Old plots remeasured	Old plots updated	Old plots replaced[1]	New plots	Total plots
All Units					
Timberland	1,496	629	1,887	1,660	4,672
Reserved forest land	24	3	8	257	298
Other forest land	36	1	28	47	112
Nonforest with trees	157	84	156	305	702
Nonforest without trees	2,105	4,645	205	4,307	11,269
Water	26	61	15	121	222
Total	3,846	5,425	2,291	6,682	17,269
Eastern Ozarks Unit					
Timberland	480	262	306	361	1,409
Reserved forest land	12	2	4	140	158
Other forest land	6	1	4	2	13
Nonforest with trees	22	16	24	30	92
Nonforest without trees	160	293	29	145	627
Water	5	2	3	9	19
Total	685	576	370	687	2,318
Southwest Ozarks Unit					
Timberland	269	125	259	263	916
Reserved forest land	8	1	1	43	53
Other forest land	12	0	8	5	25
Nonforest with trees	30	21	54	51	156
Nonforest without trees	190	445	52	245	932
Water	6	8	0	12	26
Total	515	600	374	619	2,108
Northwest Ozarks Unit					
Timberland	205	61	104	360	730
Reserved forest land	0	0	2	25	27
Other forest land	11	0	13	20	44
Nonforest with trees	22	16	19	49	106
Nonforest without trees	175	238	18	399	830
Water	4	6	1	34	45
Total	417	321	157	887	1,782
Prairie Unit					
Timberland	213	131	148	451	943
Reserved forest land	0	0	1	20	21
Other forest land	1	0	0	6	7
Nonforest with trees	66	20	49	136	271
Nonforest without trees	1,536	1,827	53	3,017	6,433
Water	12	10	3	50	75
Total	1,828	1,988	254	3,680	7,750
Riverborder Unit					
Timberland	329	50	70	226	675
Reserved forest land	4	0	0	29	33
Other forest land	6	0	3	14	23
Nonforest with trees	17	11	10	39	77
Nonforest without trees	44	1,842	53	508	2,447
Water	1	37	0	19	57
Total	401	1,940	136	835	3,312

[1] Unmonumented temporary plots and monumented permanent plots that could not be relocated.

6. Average annual removals estimates

Average annual growing-stock and sawtimber removals (1972 to 1988) were estimated only from the remeasured plots. These estimates are obtained from trees measured in the last survey and cut or otherwise removed from the timberland base. Because remeasurement plots make up about one-half of the total ground plots, average annual removals estimates have greater sampling errors than volume and growth estimates.

COMPARING MISSOURI'S FOURTH INVENTORY WITH THE THIRD INVENTORY

The following paragraphs highlight some of the procedural changes since the last inventory to assist the reader in analyzing data from this report:

New volume equations were developed for the Central States, and these equations were used to compute the 1989 volumes and to recompute the 1972 volume for growth calculations. Although the adjustment differs by Survey Unit, the recomputed 1972 growing-stock and board foot volumes will generally be greater than those shown in the 1972 report.

Mortality figures published in the 1972 inventory report were based on field estimates from a limited number of remeasurement plots. Information gathered on a larger number of remeasurement plots during the current inventory was used to adjust the 1972 mortality figures. This adjustment will also affect the estimate of net growth for the 1972 inventory.

Past surveys used only growing-stock trees to determine stand-size class. Current survey procedures require that stand-size class be determined on the basis of all live trees. Therefore, direct comparisons of current inventory data to old inventory data by stand-size class may be misleading.

The basic building block for estimating forest area and timber volume has been changed from the Survey Unit to the county. In the past, the statistics were developed at the Unit level and prorated back to the county on the basis of photo-interpretation points. Direct development of county-level data helps users interested in more precise local data, but can make the outcome of comparisons with past estimates uncertain.

LOG GRADE

In Missouri the butt log of every sawtimber sample tree was graded for quality on approximately one-third of the sample plots. The volume yield by log grade for species in this sample was used to distribute the volume of trees in the ungraded sample into log-grade classes by species group.

Logs were graded on the basis of external characteristics as indicators of quality. Hardwood species were graded according to "A guide to hardwood log grading" (Rast *et al.* 1973). The best 12-foot section of the lowest 16-foot hardwood log, or the best 12-foot upper section if the butt log did not meet minimum log-grade standards, was graded as follows:

Forest Service standard grades for hardwood factory saw logs

Grading Factors		Specifications							
		Log grade 1			Log grade 2				Log grade
Position in tree		Butts only	Butts & uppers		Butts & uppers				Butts & uppers
Scaling diameter, inches		13-15[1]	16-19	20+	11+[2]		12+		8+
Length without trim, feet			10+		10+	8-9	10-11	12+	8+
Required clear cuttings[3] of each of three best faces[4]	Min. length, feet	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	No limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook allowance	For logs with less than one-fourth of end in sound defects		15 percent				30 percent		50 percent
	For logs with more than one-fourth of end in sound defects		10 percent				20 percent		35 percent
Maximum scaling deduction			40 percent[5]				50 percent[6]		50 percent

1 Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.

2 Ten-inch logs of all species can be #2 if they otherwise meet requirements for small #1's.

3 A clear cutting is a portion of a face, extending the width of the face, that is free of defects.

4 A face is one-fourth of the surface of the log as divided lengthwise.

5 Otherwise #1 logs with 41- to 60-percent deductions can be #2.

6 Otherwise #2 logs with 51- to 60-percent deductions can be #3.

Forest Service standard specifications for hardwood construction logs (tie and timber logs)[1]

Position in tree	Butts and uppers
Min. diameter, small end	8 inches +
Min. length without trim	8 feet
Clear cuttings	No requirements
Sweep allowance	One-fourth of the diameter at the small end for each 8 feet of length.
Sound surface defects:	
Single knots	Any number, if no one knot has an average diameter above the callus in excess of one-third of the log diameter at point of occurrence.
Whorled knots	Any number, if the sum of knot diameters above the callus does not exceed one-third of the log diameter at point of occurrence.
Holes	Any number provided none has a diameter over one-third of the log diameter at point of occurrence, and none extends more than 3 inches into included timber[2].
Unsound surface defects :	Same requirements as for sound defects if they extend into included timber. No limit if they do not.
End defects:	
Sound	No requirements.
Unsound	None allowed; log must be sound internally, but will admit one shake not to exceed one-fourth the scaling diameter and will admit one longitudinal split not extending more than 5 inches into included timber.

[1]These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, it may be necessary to subdivide the class into grades.

[2]Included timber is always square, and dimension is judged from small end.

Log grades for southern pine logs

Grade 1: logs with three or four clear faces[1] and 16 inches minimum d.i.b.

Grade 2: logs with one or two clear faces and 12 inches minimum d.i.b.

Grade 3: logs with no clear faces and 6 inch minimum d.i.b.

After the tentative log grade is established from above, the log will be degraded one grade for each of the following, except that no log can be degraded below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

1. *Sweep.* Degrade any tentative 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one-third of the diameter inside bark at small end.

2. *Heart rot.* Degrade any tentative 1 or 2 log one grade if conk, massed hyphae, or other evidence of advanced heart rot is found anywhere in it.

[1]A face is one-fourth of the circumference in width extending full length of the log. Clear faces are those free of: knots measuring more than 1 inch in diameter, overgrown knots of any size, and holes more than one inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.

Log grades for eastern redcedar (Missouri special use)

Position in tree	Butts and uppers
D.B.H.	6 inches +
Min. diameter(ob), small end	5 inches +
Length without trim	7 feet
Clear cuttings	No requirements
Sweep allowance	Reasonably straight
Sound surface defects permitted:	
Single knot	Any number less than one-half of the log diameter at point of occurrence.
Whorled knots	Any number provided the sum of the diameter of knots 2 inches or larger in a 1-foot section does not exceed the diameter at that point.
Unsound defects permitted:	Any number, provided defect is not greater than one-half of the volume at any one point of occurrence.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.
1 pound = 0.454 kilograms.
1 ton = 0.907 metric tons.

TREE SPECIES GROUPS IN MISSOURI[4]

SOFTWOODS

Shortleaf pine ..... *Pinus echinata*
Virginia pine ..... *Pinus virginiana*
Baldcypress ..... *Taxodium distichum*
Eastern redcedar ..... *Juniperus virginiana*
Other softwoods
  Scotch pine ..... *Pinus sylvestris*

HARDWOODS

Select white oak[5]
  White oak ..... *Quercus alba*
  Swamp white oak ..... *Quercus bicolor*
  Bur oak ..... *Quercus macrocarpa*
  Swamp chestnut oak ..... *Quercus michauxii*
  Chinkapin oak ..... *Quercus muehlenbergii*
Other white oak[5]
  Overcup oak ..... *Quercus lyrata*
  Chestnut oak ..... *Quercus prinus*
  Post oak ..... *Quercus stellata*
Select red oak[5]
  Cherrybark oak ..... *Quercus falcata* var. *pagodifolia*
Northern red oak ..... *Quercus rubra*
Shumard oak ..... *Quercus shumardii* var. *shumardii*
Other red oak[5]
  Scarlet oak ..... *Quercus coccinea*
  Northern pin oak ..... *Quercus ellipsoidalis*
  Southern red oak ..... *Quercus falcata*
  Shingle oak ..... *Quercus imbricaria*
  Black oak ..... *Quercus velutina*
  Blackjack oak ..... *Quercus marilandica*
  Pin oak ..... *Quercus palustris*
  Willow oak ..... *Quercus phellos*
Select hickory[5]
  Pecan ..... *Carya illinoensis*
  Shellbark hickory ..... *Carya lacinosa*
  Shagbark hickory ..... *Carya ovata*
  Mockernut hickory ..... *Carya tomentosa*
Other hickory[5]
  Bitternut hickory ..... *Carya cordiformis*
  Pignut hickory ..... *Carya glabra*
  Black hickory ..... *Carya texana*
River birch[5] ..... *Betula nigra*
Hard maple[5]
  Sugar maple ..... *Acer saccharum*
Soft maple[6]
  Red maple ..... *Acer rubrum*
  Silver maple ..... *Acer saccharinum*
Ash[5]
  Blue ash ..... *Fraxinus quadrangulata*
  White ash ..... *Fraxinus americana*
  Green ash ..... *Fraxinus pennsylvanica*
Cottonwood[6] ..... *Populus deltoides*
Basswood[6] ..... *Tilia americana*
Beech[5] ..... *Fagus grandifolia*
Black walnut[5] ..... *Juglans nigra*
Black cherry[6] ..... *Prunus serotina*
Butternut[6] ..... *Juglans cinerea*
Elm
  Winged elm[6] ..... *Ulmus alata*
  American elm[6] ..... *Ulmus americana*
  Slippery elm[6] ..... *Ulmus rubra*
  Rock elm[5] ..... *Ulmus thomasii*
Hackberry[6] ..... *Celtis occidentalis*
Sycamore[6] ..... *Platanus occidentalis*
Yellow-poplar[6] ..... *Liriodendron tulipifera*
Black willow[6] ..... *Salix nigra*
Sweetgum[6] ..... *Liquidambar styraciflua*
Tupelo[6]
  Black tupelo ..... *Nyssa sylvatica* var. *sylvatica*
  Swamp tupelo ..... *Nyssa sylvatica* var. *biflora*
Persimmon[5] ..... *Diospyros virginiana*
Sassafras[6] ..... *Sassafras albidum*
Other hardwoods
  Ohio buckeye[6] ..... *Aesculus glabra*
  Boxelder[6] ..... *Acer negundo*
  Kentucky coffeetree[5] ..... *Gymnocladus dioicus*
  Black locust[5] ..... *Robinia pseudoacacia*
  White mulberry[6] ..... *Morus alba*
  Red mulberry[6] ..... *Morus rubra*
  Honeylocust[5] ..... *Gleditsia triacanthos*
  Northern catalpa[5] ..... *Catalpa speciosa*
Noncommercial species
  Osage-orange ..... *Maclura pomifera*
  Eastern hophornbeam ..... *Ostrya virginiana*
  Apple ..... *Malus* spp.
  American hornbeam ..... *Carpinus caroliniana*
  Wild plum ..... *Prunus* spp.
  Eastern redbud ..... *Cercis canadensis*
  Pawpaw ..... *Asimina triloba*
  Hawthorn ..... *Crataegus* spp.

[4] *The common and scientific names are based on Little (1979).*

[5] *This species or species group is considered a hard hardwood, with an average specific gravity greater than or equal to 0.50.*

[6] *This species or species group is considered a soft hardwood, with an average specific gravity of 0.50 or less.*

DEFINITION OF TERMS

Average annual removals from growing stock.—The average net growing-stock volume in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other uses (see Other removals). Average annual removals of growing stock are reported for a period of several years (1972 to 1988 in this report) and are based on information obtained from remeasurement plots (see Survey Procedures in Appendix).

Average annual removals from sawtimber.—The average net board foot sawtimber volume of live sawtimber trees removed annually for forest products (including roundwood products and other uses [see Other removals]). Average annual removals of sawtimber are reported for a period of several years (1972 to 1988 in this report) and are based on information obtained from remeasurement plots (see Survey Procedures in Appendix).

Basal area.—The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Biomass.—The above-ground volume of all live trees (includes bark, but excludes foliage) reported in green tons. Biomass is made up of 4 components:

Bole.—Biomass of a tree from 1 foot above the ground to a 4-inch top outside bark.

Tops and limbs.—Total biomass of a tree from a 1-foot stump minus the bole.

1- to 5-inch trees.—Total above-ground biomass of a tree from 1- to 5-inches in diameter at breast height.

Stump.—Biomass of a tree 5-inches d.b.h. and larger from the ground to a height of 1 foot.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, Osage-orange, and redbud.)

Commercial forest land.—(See Timberland).

County and municipal land.—Land owned by counties and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Cropland.—Land under cultivation within the past 24 months; including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

Cull.—Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Current annual removals from growing stock.—The current net growing-stock volume in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other uses (see Other removals). Current annual removals of growing stock are reported for a single year (1987 in this report) and are based on a survey of primary wood processing mills to determine removals for products and information from remeasurement plots (see Survey Procedures in Appendix) to determine removals due to land use change.

Current annual removals from sawtimber.—The current net board foot sawtimber volume of live sawtimber trees removed annually for forest products (including roundwood products and other uses [see Other removals]). Current annual removals of sawtimber are reported for a single year (1987 in this report) and are based on a survey of primary wood processing mills to determine removals for products and information from remeasurement plots (see Survey Procedures in Appendix) to determine removals due to land use change.

Diameter classes.—A classification of trees based on diameter outside bark, measured at breast height (4.5 feet above the ground). (Note: d.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter

classes are commonly used in Forest Inventory and Analysis, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.).

Diameter at breast height (d.b.h.).—The outside bark diameter at 4.5 feet (1.37 m) above the forest floor on the uphill side of the tree. For the purposes of determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

Farm.—Any place from which $1,000 or more of agricultural products were produced and sold during the year.

Farmer-owned land.—Land owned by farm operators whether part of the farmstead or not. (Note: Excludes land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and/or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide. (See Tree, Land, Timberland, Reserved forest land, Other forest land, Stocking, and Water.)

Forest industry land.—Land owned by companies or individuals operating primary wood-using plants.

Forest type.—A classification of forest land based on the species forming a plurality of live tree stocking. Major forest types in the State are:

Shortleaf pine.—Forests in which shortleaf pine comprises a plurality of the stocking. (Common associates include oak, hickory, and gum.)

Eastern redcedar.—Forests in which eastern redcedar comprises a plurality of the stocking. (Common associates include oak and hickory.)

Eastern redcedar-hardwood.—Forests in which hardwoods (usually upland oaks), comprise a plurality of the stocking but where eastern redcedar comprises 25 to 50 percent of the stocking. (Common associates include gum and hickory)

Shortleaf pine-oak.—Forests in which hardwoods (usually white, scarlet, chestnut, northern red or black oaks), singly or in combination, comprise a plurality of the stocking but where shortleaf pine comprises 25 to 50 percent of the stocking.

Post-blackjack oak.—Forests in which post or blackjack oak, singly or in combination, comprise a plurality of the stocking, and less than 25 percent of the stocking is in pines or eastern redcedar.

Black-scarlet oak.—Forests in which black oak or scarlet oak, singly or in combination, comprise a plurality of the stocking, and less than 25 percent of the stocking is in pines or eastern redcedar. (Common associates include elm, maple, and black walnut.)

White oak.—Forests in which white oak species singly or in combination, comprise a plurality of the stocking, and less than 25 percent of the stocking is in pines or eastern redcedar.

Oak-gum-cypress.—Bottomland forests in which bottomland oaks such as pin, swamp white, and shingle oaks along with tupelo, blackgum, sweetgum, or cypress, singly or in combination, comprise a plurality of the stocking. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Elm-ash-soft maple.—Forests in which lowland elm, ash, soft maple, and cottonwood, singly or in combination, comprise a plurality of the stocking. (Common associates include boxelder, willow, sycamore, and beech.)

Cottonwood.—Forests in which cottonwood comprises at least 50 percent of the stocking. (Associates include willow, elm, soft maple, and ash.)

Maple-beech.—Forests in which hard maple or beech, singly or in combination, comprise a plurality of the stocking. (Common associates include soft maple, elm, and basswood.)

Growing-stock trees.—Live trees of commercial species that meet specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5 inches d.b.h. and over, from 1 foot above the ground to a minimum 4-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs. Cubic feet can be converted to standard cords by dividing by 79. One standard cord is 128 cubic feet of stacked wood, including bark and air.

Hard hardwoods.—Hardwood species with an average specific gravity greater than 0.50 such as oaks, hard maple, hickories, and ash.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous. (See Soft hardwoods and Hard hardwoods.)

Improved pasture.—Land currently improved for grazing by cultivating, seeding, irrigating, or clearing of trees or brush and less than 16.7 percent stocked with live trees.

Industrial wood.—All roundwood products, except fuelwood.

Land.—A. *Bureau of the Census.* Dry land and land temporarily or partly covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

B. *Forest Inventory and Analysis.* The same as the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.

Live trees.—Growing-stock, rough, and rotten trees 1.0 inch d.b.h. and larger.

Log grades.—A classification of logs based on external characteristics as indicators of quality or value. (See Appendix for specific grading factors used.)

Logging residues.—The unused growing stock portions of trees cut or killed by logging.

Maintained road.—Any road, hard-topped or other surface, that is plowed or graded at least once a year. Includes rights-of-way that are cut or treated to limit herbaceous growth.

Marsh.—Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation and that is intermittently covered with water.

Merchantable.—Refers to a pulpwood or saw-log section that meets pulpwood or saw-log specifications, respectively.

Miscellaneous Federal land.—Federal land other than National Forest land.

Miscellaneous private land.—Privately owned land other than forest-industry and farmer-owned land.

Mortality.—The volume of sound wood in growing-stock and sawtimber trees that die annually.

National Forest land.—Federal land that has been legally designated as National Forest or purchase units, and other land administered by the USDA Forest Service.

Net annual growth of growing stock.—The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber.—The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Net volume.—Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area to qualify as nonforest land.)

a. *Nonforest land without trees*.—Nonforest land with no live trees present.

b. *Nonforest land with trees*.—Nonforest land with one or more trees per acre at least 5 inches d.b.h.

Nonstocked land.—Timberland less than 16.7 percent stocked with growing-stock trees.

Other forest land.—Forest land not capable of producing 20 cubic feet per acre per year of industrial wood crops under natural conditions and not associated with urban or rural development. These sites often contain tree species that are not currently utilized for industrial wood production or trees of poor form, small size, or inferior quality that are unfit for industrial products. Low productivity may be the result of adverse site conditions such as sterile soil, dry climate, poor drainage, high elevation, and rockiness. This land is not withdrawn from timber utilization.

Other removals.—Growing-stock trees removed but not utilized for products, or trees left standing but "removed" from the timberland classification by land use change. Examples are removals resulting from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Ownership.—Property owned by one owner, regardless of the number of parcels in a specified area.

Ownership size class.—The amount of timberland owned by one owner, regardless of the number of parcels.

Owner tenure.—The length of time a property has been held by the owner.

Pasture.—Land presently used for grazing or under cultivation to develop grazing.

Pastured timberland.—Timberland for which the primary use is wood production, but is presently used for grazing.

Plant byproducts.—Plant residues used for products such as mulch, pulp chips, and fuelwood.

Plant residues.—Wood and bark materials generated at manufacturing plants during production of other products.

Plantation.—An artificially reforested area sufficiently productive to qualify as timberland. The planted species is not necessarily predominant. Christmas tree plantations, which are considered reserved forest land, are not included.

Poletimber stand.—(See Stand-size class.)

Poletimber tree.—A live tree of commercial species at least 5 inches d.b.h. but smaller than sawtimber size.

Potential productivity class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

Reserved forest land.—Forest land withdrawn from timber utilization through statute, administrative regulation, designation, or exclusive use for Christmas tree production, as indicated by annual shearing.

Rotten trees.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products.—Logs, bolts, or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split,or hewn products.)

Salvable dead trees.—Standing or down dead trees considered merchantable by regional standards.

Saplings.—Live trees 1 to 5 inches d.b.h.

Sapling-seedling stands.—(See Stand-size class.)

Saw log.—A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by regional standards.

Saw-log portion.—That part of the bole of sawtimber trees between the stump and the saw-log top.

Saw-log top.—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw-log top is 7 inches d.o.b. for softwoods and 9 inches d.o.b. for hardwoods.

Sawtimber stands.—(See Stand-size class.)

Sawtimber tree.—A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9 inches d.b.h. Hardwoods must be at least 11 inches d.b.h.

Sawtimber volume.—Net volume of the saw-log portion of live sawtimber in board feet, International 1/4-inch rule (unless specified otherwise) from stump to a minimum 7 inches top diameter outside bark (d.o.b.) for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Seedlings.—Live trees less than 1 inch d.b.h. that are expected to survive. Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Short-log (rough tree).—Sawtimber-size tree of commercial species that contains at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Soft hardwoods.—Hardwood species with an average specific gravity of 0.50 or less such as gum, yellow-poplar, cottonwood, red maple, basswood, and willow.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand.—A group of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class.—Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-size class.—A classification of stocked (see Stocking) forest land based on the size class of live trees on the area; that is, sawtimber, poletimber, or seedlings and saplings.

a. *Sawtimber stands*.—Stands with half or more of live stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

b. *Poletimber stands*.—Stands with half or more live stocking in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

c. *Sapling-seedling stands*.—Stands with more than half of the live stocking in saplings and/or seedlings.

State land.—Land owned by States or leased to them for 50 years or more.

Stocking.—The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stands are grouped into the following stocking classes:

Overstocked stands.—Stands in which stocking of trees is 133.0 percent or more.

Fully stocked stands.—Stands in which stocking of trees is from 100.0 to 132.9 percent.

Moderately stocked stands.—Stands in which stocking of trees is from 60.0 to 99.9 percent.

Poorly stocked stands.—Stands in which stocking of trees is from 16.7 to 59.9 percent.

Nonstocked areas.—Commercial forest land on which stocking of trees is less than 16.7 percent.

Timberland.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as timberland are capable of producing more than 20 cubic feet per acre per year of annual growth when managed. Currently inaccessible and inoperable areas are included except when the areas involved are small and unlikely to become suitable for producing industrial wood in the foreseeable future.) Formerly called commercial forest land. (See Pastured timberland.)

Timber products output.—All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edging, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Tree.—Woody plant having a well-developed stem and usually more than 12 feet tall at maturity.

Tree biomass.—The total aboveground weight (including bark) of all trees from 1 to 5 inches in d.b.h., and the total aboveground weight (including bark) from a 1-foot stump for trees more than 5 inches in diameter.

Tree size class.—A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Upper-stem portion.—That part of the bole of sawtimber trees above the saw-log top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Urban and other areas.—Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; schoolyards; cemeteries; roads; railroads; airports; beaches; powerlines and other rights-of-way; or other nonforest land not included in any other specified land use class.

Urban forest land.—Land that would otherwise meet the criteria for timberland, but is in an urban-suburban area surrounded by commercial, industrial, or residential development and not likely to be managed for the production of industrial wood products on a continuing basis. Wood removed would be for land clearing, fuelwood, or aesthetic purposes. Such forest land may be associated with industrial, commercial, residential, or recreational nonforest uses. Residential subdivisions, industrial parks, golf course perimeters, airport buffer strips, and public urban parks that qualify as forest land are included.

Water.—A. *Bureau of the Census*.—Permanent inland water surfaces, such as lakes, reservoirs, and ponds at least 40 acres in area; and streams, sloughs, estuaries, and canals at least one-eighth of a statute mile wide.

B. *Noncensus*.—Permanent inland water surfaces, such as lakes, reservoirs, and ponds from 1 to 39.9 acres in area; and streams, sloughs, estuaries, and canals from 120 feet to one-eighth of a statute mile wide.

Windbreak.—A group of trees whose primary use is to protect buildings currently in use.

Wooded pasture.—Improved pasture with more than 16.7 percent stocking in live trees but less than 25 percent stocking in growing-stock trees. Area is currently improved for grazing or there is other evidence of grazing.

Wooded strip.—An acre or more of natural continuous forest land that would otherwise meet survey standards for timberland except that it is less than 120 feet wide.

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(In thousand acres)

Unit and County	Land area	Forest land					Nonforest land	Nonforest land with trees, as a percent of land area
		All forest land	Timber-land	Timberland as a percent of land area	Other forest land	Reserved forest land		
Eastern Ozarks Unit								
Bollinger	397.2	215.5	215.5	54.3	--	--	6.2	1.6
Butler	446.7	136.7	130.7	29.3	--	6.0	19.2	4.3
Carter	325.8	283.2	266.4	81.8	--	16.8	6.4	2.0
Crawford	475.9	325.4	321.9	67.6	3.5	--	25.7	5.4
Dent	483.1	308.8	302.4	62.6	2.0	4.4	24.6	5.1
Iron	353.3	291.0	275.9	78.1	6.7	8.4	19.6	5.5
Madison	318.2	249.4	239.6	75.3	3.0	6.8	2.6	0.8
Oregon	506.9	318.5	292.6	57.7	--	25.9	32.6	6.4
Reynolds	517.4	429.4	425.5	82.2	--	3.9	18.0	3.5
Ripley	404.2	269.0	269.0	66.6	--	--	20.8	5.1
St. Francois	288.7	160.9	142.3	49.3	8.2	10.4	8.4	2.9
Shannon	642.4	533.2	466.5	72.6	7.8	58.9	24.5	3.8
Washington	487.8	376.7	375.2	76.9	--	1.5	31.4	6.4
Wayne	487.9	402.6	386.5	79.2	--	16.1	2.6	0.5
Total	6,135.5	4,300.3	4,110.0	67.0	31.2	159.1	242.6	4.0
Southwest Ozarks Unit								
Barry	495.0	217.2	201.7	40.7	3.5	12.0	23.6	4.8
Christian	360.9	152.4	143.5	39.8	8.9	--	5.4	1.5
Douglas	521.0	303.5	300.3	57.6	3.2	--	35.6	6.8
Howell	593.7	277.8	277.8	46.8	--	--	62.4	10.5
McDonald	345.9	184.7	184.7	53.4	--	--	12.0	3.5
Newton	401.1	97.6	97.6	24.3	--	--	37.4	9.3
Ozark	467.6	271.3	251.0	53.7	8.1	12.2	34.8	7.4
Stone	288.6	126.3	125.1	43.3	--	1.2	32.9	11.4
Taney	389.0	274.2	230.6	59.3	29.8	13.8	16.5	4.2
Texas	755.5	426.3	412.7	54.6	--	13.6	50.2	6.6
Webster	380.0	122.9	118.4	31.2	4.5	--	43.9	11.6
Wright	436.7	159.2	154.8	35.4	4.4	--	33.8	7.7
Total	5,435.0	2,613.4	2,498.2	46.0	62.4	52.8	388.5	7.1
Northwest Ozarks Unit								
Benton	466.8	202.9	188.6	40.4	13.0	1.3	41.6	8.9
Camden	410.3	263.4	235.4	57.4	16.1	11.9	26.7	6.5
Cedar	301.1	88.8	84.0	27.9	1.9	2.9	21.7	7.2
Dallas	347.3	142.1	136.9	39.4	4.7	0.5	20.9	6.0
Hickory	242.5	97.2	83.9	34.6	12.6	0.7	21.8	9.0
Laclede	491.2	210.4	207.0	42.1	3.4	--	32.3	6.6
Maries	338.1	160.5	137.2	40.6	23.3	--	38.3	11.3
Miller	379.3	187.9	173.4	45.7	4.6	9.9	27.9	7.4
Morgan	380.1	190.1	172.9	45.5	17.2	--	22.2	5.8
Phelps	431.1	269.3	262.9	61.0	6.4	--	15.0	3.5
Polk	407.1	109.4	105.0	25.8	4.4	--	17.1	4.2
Pulaski	351.9	220.7	220.7	62.7	--	--	15.2	4.3
St. Clair	447.0	170.7	161.7	36.2	9.0	--	25.1	5.6
Total	4,993.8	2,313.4	2,169.6	43.4	116.6	27.2	325.8	6.5
Prairie Unit								
Adair	362.8	70.3	68.5	18.9	--	1.8	12.1	3.3
Andrew	278.7	17.4	17.4	6.2	--	--	29.4	10.5
Atchison	346.8	16.6	16.6	4.8	--	--	--	--
Audrain	446.3	34.3	34.3	7.7	--	--	10.1	2.3
Barton	381.7	39.2	38.7	10.1	--	0.5	8.7	2.3
Bates	543.7	60.0	60.0	11.0	--	--	21.7	4.0
Buchanan	261.9	26.7	26.7	10.2	--	--	13.6	5.2
Caldwell	275.5	20.1	20.1	7.3	--	--	12.0	4.4
Carroll	445.1	40.9	40.9	9.2	--	--	8.7	2.0
Cass	448.9	51.3	51.3	11.4	--	--	29.6	6.6
Chariton	485.1	53.1	51.1	10.5	--	2.0	9.5	2.0
Clark	324.5	70.9	70.9	21.8	--	--	8.7	2.7
Clay	258.2	23.1	22.1	8.6	--	1.0	7.8	3.0
Clinton	270.7	12.6	11.0	4.1	--	1.6	8.9	3.3
Cooper	362.6	53.2	53.2	14.7	--	--	39.3	10.8
Dade	313.9	40.2	40.2	12.8	--	--	19.1	6.1

(Table 8 continued on next page)

(Table 8 continued)

Unit and County	Land area	Forest land					Nonforest land with trees	Nonforest land with trees, as a percent of land area
		All forest land	Timber-land	Timberland as a percent of land area	Other forest land	Reserved forest land		
Prairie Unit, continued								
Daviess	363.4	41.4	41.4	11.4	--	--	5.0	1.4
De Kalb	271.8	11.4	11.4	4.2	--	--	10.8	4.0
Gentry	315.5	30.4	30.4	9.6	--	--	11.0	3.5
Greene	433.6	78.9	78.9	18.2	--	--	22.5	5.2
Grundy	279.9	17.7	17.2	6.1	--	0.5	7.2	2.6
Harrison	464.1	47.9	47.9	10.3	--	--	15.8	3.4
Henry	466.6	87.3	87.3	18.7	--	--	21.6	4.6
Holt	292.2	27.1	27.1	9.3	--	--	5.7	2.0
Jackson	391.0	38.9	38.9	9.9	--	--	20.1	5.1
Jasper	410.4	54.9	54.9	13.4	--	--	6.4	1.6
Johnson	533.5	66.8	66.0	12.4	--	0.8	43.4	8.1
Knox	324.3	40.5	39.1	12.1	1.4	--	7.1	2.2
Lafayette	404.8	28.9	28.9	7.1	--	--	18.8	4.6
Lawrence	392.6	58.2	58.2	14.8	--	--	12.2	3.1
Lewis	325.4	63.1	63.1	19.4	--	--	8.0	2.5
Lincoln	401.6	112.2	106.2	26.4	--	6.0	1.4	0.3
Linn	396.5	36.4	32.7	8.2	2.8	0.9	5.0	1.3
Livingston	343.4	37.8	37.8	11.0	--	--	7.6	2.2
Macon	509.8	80.2	80.2	15.7	--	--	22.9	4.5
Marion	280.4	49.8	49.8	17.8	--	--	5.9	2.1
Mercer	290.7	29.6	29.6	10.2	--	--	0.9	0.3
Monroe	428.7	76.4	72.2	16.8	2.4	1.8	15.4	3.6
Nodaway	560.1	35.4	35.4	6.3	--	--	11.8	2.1
Pettis	439.2	58.6	58.6	13.3	--	--	34.2	7.8
Pike	430.9	116.6	112.2	26.0	4.4	--	10.5	2.4
Platte	269.5	45.0	45.0	16.2	--	--	13.8	5.0
Putnam	333.1	59.8	59.8	18.0	--	--	17.1	5.1
Ralls	308.2	61.7	61.7	19.9	--	--	3.8	1.2
Randolph	305.2	45.1	45.1	14.1	--	--	12.7	4.0
Ray	363.8	48.5	48.5	13.1	--	--	26.0	7.0
Saline	483.1	49.4	49.4	9.9	--	--	32.8	6.6
Schuyler	197.5	26.2	26.2	13.3	--	--	15.6	7.9
Scotland	280.6	30.3	30.3	10.8	--	--	12.4	4.4
Shelby	320.5	47.8	47.8	14.8	--	--	4.5	1.4
Sullivan	416.9	50.4	50.4	12.1	--	--	11.5	2.8
Vernon	535.7	93.4	89.1	16.6	4.3	--	16.5	3.1
Worth	170.4	18.6	18.6	10.9	--	--	5.4	3.2
Total	19,541.3	2,532.5	2,500.3	12.6	15.3	16.9	742.5	3.8
Riverborder Unit								
Boone	439.5	124.2	107.0	24.3	10.8	6.4	18.0	4.1
Callaway	539.1	192.3	181.3	33.6	11.0	--	35.4	6.6
Cape Girardeau	369.2	98.4	94.5	25.6	--	3.9	--	--
Cole	250.7	71.1	71.1	28.4	--	--	25.7	10.3
Dunklin	350.0	21.8	21.8	6.2	--	--	2.1	0.6
Franklin	590.0	257.1	248.3	42.1	3.5	5.3	35.7	6.1
Gasconade	333.3	161.3	139.9	42.0	21.4	--	18.1	5.4
Howard	297.3	60.4	60.4	20.3	--	--	15.1	5.1
Jefferson	423.1	227.9	222.5	52.6	5.4	--	32.0	7.6
Mississippi	262.3	14.4	13.7	5.2	--	0.7	--	--
Moniteau	266.7	54.6	54.6	20.5	--	--	5.8	2.2
Montgomery	345.7	103.7	98.5	28.5	5.2	--	16.8	4.9
New Madrid	421.3	18.9	18.9	4.5	--	--	--	--
Osage	387.6	162.4	141.7	36.6	20.7	--	22.3	5.8
Pemiscot	331.2	11.3	11.3	3.4	--	--	--	--
Perry	303.0	116.6	116.6	38.5	--	--	--	--
St. Charles	357.0	89.6	83.8	23.5	4.1	1.7	7.1	2.0
St. Louis	323.5	57.1	31.9	9.9	--	25.2	26.3	8.1
Ste. Genevieve	322.4	192.7	177.3	55.0	0.2	15.2	0.2	0.1
Scott	270.7	19.1	19.1	7.1	--	--	0.4	0.1
Stoddard	521.6	50.3	47.8	9.2	--	2.5	7.8	1.5
Warren	274.8	133.4	130.7	47.6	2.7	--	9.2	3.3
City of St. Louis	39.3	--	--	--	--	--	--	--
Total	8,019.3	2,238.6	2,092.7	26.1	85.0	60.9	278.0	3.5
All counties	44,124.9	13,998.2	13,370.8	30.3	310.5	316.9	1,977.4	4.5

Table 9.--Area of timberland by county and ownership class, Missouri, 1989

(In thousand acres)

Unit and County	All owners	Ownership class							
		National forest	Misc. federal	State	County & municipal	Forest industry	Farmer	Misc. private corporation	Misc. private individual
Eastern Ozarks Unit									
Bollinger	215.5	1.6	--	--	--	--	127.6	13.5	72.8
Butler	130.7	47.4	--	3.1	--	--	15.7	7.8	56.7
Carter	266.4	90.2	--	20.6	--	13.2	13.3	9.6	119.5
Crawford	321.9	48.3	10.2	14.2	--	--	69.2	18.7	161.3
Dent	302.4	67.3	--	28.3	--	3.2	97.6	14.7	91.3
Iron	275.9	81.2	3.3	--	--	--	31.1	25.6	134.7
Madison	239.6	38.8	--	3.4	--	--	71.8	21.7	103.9
Oregon	292.6	71.0	--	--	--	8.9	89.4	45.2	78.1
Reynolds	425.5	85.5	14.9	38.9	--	62.6	70.8	23.8	129.0
Ripley	269.0	94.2	--	4.7	--	--	74.5	2.3	93.3
St. Francois	142.3	0.9	--	--	--	2.7	42.2	13.2	83.3
Shannon	466.5	83.4	2.4	59.2	--	69.6	61.3	20.4	170.2
Washington	375.2	78.1	3.5	9.9	--	10.7	133.2	51.4	88.4
Wayne	386.5	85.9	6.8	14.8	--	13.4	37.2	21.5	206.9
Total	4,110.0	873.8	41.1	197.1	--	184.3	934.9	289.4	1,589.4
Southwest Ozarks Unit									
Barry	201.7	42.3	--	2.5	--	--	107.3	6.0	43.6
Christian	143.5	41.5	--	--	--	--	57.8	2.7	41.5
Douglas	300.3	37.1	--	--	--	--	137.8	5.3	120.1
Howell	277.8	47.9	--	12.5	--	--	106.3	3.6	107.5
McDonald	184.7	--	--	3.4	--	--	54.2	9.6	117.5
Newton	97.6	--	8.3	--	--	--	47.8	10.0	31.5
Ozark	251.0	20.2	8.4	4.4	--	--	109.6	2.8	105.6
Stone	125.1	14.7	--	--	--	--	46.0	7.3	57.1
Taney	230.6	44.7	--	8.2	--	--	111.1	10.6	56.0
Texas	412.7	38.6	--	2.8	2.6	30.4	224.3	20.6	93.4
Webster	118.4	--	--	4.3	2.5	--	94.2	5.0	12.4
Wright	154.8	7.0	--	--	--	--	108.8	2.6	36.4
Total	2,498.2	294.0	16.7	38.1	5.1	30.4	1,205.2	86.1	822.6
Northwest Ozarks Unit									
Benton	188.6	--	22.6	5.4	--	--	70.6	13.0	77.0
Camden	235.4	--	--	--	--	--	77.5	15.2	142.7
Cedar	84.0	--	1.7	--	--	--	48.0	1.9	32.4
Dallas	136.9	--	--	7.7	--	--	61.7	2.5	65.0
Hickory	83.9	--	10.5	--	--	--	38.5	5.7	29.2
Laclede	207.0	27.8	--	4.6	--	--	59.2	9.2	106.2
Maries	137.2	--	2.2	3.5	--	--	46.0	10.5	75.0
Miller	173.4	--	--	--	--	--	53.0	15.9	104.5
Morgan	172.9	--	--	--	--	--	70.3	8.6	94.0
Phelps	262.9	62.5	--	2.3	--	--	109.3	5.3	83.5
Polk	105.0	--	4.4	2.9	--	--	31.5	--	66.2
Pulaski	220.7	44.8	40.2	--	2.9	--	66.8	--	66.0
St. Clair	161.7	--	20.4	--	--	--	68.2	6.1	67.0
Total	2,169.6	135.1	102.0	26.4	2.9	--	800.6	93.9	1,008.7
Prairie Unit									
Adair	68.5	--	--	--	2.7	--	18.2	2.7	44.9
Andrew	17.4	--	--	--	--	--	14.6	--	2.8
Atchison	16.6	--	--	1.8	--	--	12.1	--	2.7
Audrain	34.3	--	--	2.5	--	--	22.6	7.8	1.4
Barton	38.7	--	--	--	--	--	14.0	9.7	15.0
Bates	60.0	--	--	--	1.5	--	32.9	8.1	17.5
Buchanan	26.7	--	--	3.6	--	--	17.5	--	5.6
Caldwell	20.1	--	--	--	--	--	12.9	--	7.2
Carroll	40.9	--	--	3.6	--	--	27.8	--	9.5
Cass	51.3	--	--	2.1	--	--	13.6	12.8	22.8
Chariton	51.1	--	--	--	--	--	5.9	42.6	2.6
Clark	70.9	--	5.3	--	4.5	--	16.9	7.5	36.7
Clay	22.1	--	--	--	4.3	--	11.3	2.2	4.3
Clinton	11.0	--	--	--	--	--	8.4	--	2.6
Cooper	53.2	--	--	2.5	--	--	14.5	2.5	33.7

(Table 9 continued on next page)

(Table 9 continued)

Unit and County	All owners	Ownership class							
		National forest	Misc. federal	State	County & municipal	Forest industry	Farmer	Misc. private corporation	Misc. private individual
Prairie Unit, continued									
Dade	40.2	--	13.1	--	--	--	21.5	2.1	3.5
Daviess	41.4	--	--	--	--	--	34.5	--	6.9
De Kalb	11.4	--	--	1.6	--	--	9.8	--	--
Gentry	30.4	--	--	--	--	--	21.5	--	8.9
Greene	78.9	--	--	3.1	3.1	--	27.2	12.6	32.9
Grundy	17.2	--	--	--	--	--	5.8	4.6	6.8
Harrison	47.9	--	--	--	--	--	34.3	2.1	11.5
Henry	87.3	--	20.2	1.1	--	--	19.5	2.4	44.1
Holt	27.1	--	--	--	--	--	13.0	--	14.1
Jackson	38.9	--	6.0	1.3	6.0	--	4.6	7.3	13.7
Jasper	54.9	--	--	--	--	--	38.2	7.8	8.9
Johnson	66.0	--	--	1.7	--	--	17.8	3.4	43.1
Knox	39.1	--	--	--	--	--	24.4	--	14.7
Lafayette	28.9	--	--	--	--	--	10.9	12.6	5.4
Lawrence	58.2	--	--	--	--	--	27.4	5.7	25.1
Lewis	63.1	--	2.9	2.9	--	--	40.1	11.8	5.4
Lincoln	106.2	--	2.8	--	--	--	36.4	7.6	59.4
Linn	32.7	--	--	--	--	--	15.0	2.8	14.9
Livingston	37.8	--	--	--	--	--	26.8	--	11.0
Macon	80.2	--	0.6	1.3	--	--	13.5	19.3	45.5
Marion	49.8	--	--	--	--	--	43.8	--	6.0
Mercer	29.6	--	--	--	--	--	24.2	--	5.4
Monroe	72.2	--	15.4	--	--	--	30.8	4.6	21.4
Nodaway	35.4	--	--	--	--	--	33.7	--	1.7
Pettis	58.6	--	3.4	--	--	--	41.6	7.8	5.8
Pike	112.2	--	2.2	5.7	--	--	40.8	6.6	56.9
Platte	45.0	--	--	--	1.8	--	28.2	3.9	11.1
Putnam	59.8	--	--	8.4	--	--	28.1	7.2	16.1
Ralls	61.7	--	3.5	--	--	--	30.2	2.8	25.2
Randolph	45.1	--	--	--	--	--	18.8	7.0	19.3
Ray	48.5	--	--	--	1.9	--	25.9	--	20.7
Saline	49.4	--	2.2	2.2	--	--	32.4	2.2	10.4
Schuyler	26.2	--	--	--	--	--	8.0	10.0	8.2
Scotland	30.3	--	--	2.4	--	--	17.2	4.5	6.2
Shelby	47.8	--	--	--	--	--	33.4	--	14.4
Sullivan	50.4	--	--	2.7	--	--	31.6	10.7	5.4
Vernon	89.1	--	--	3.2	--	--	66.7	--	19.2
Worth	18.6	--	--	--	--	--	11.2	7.4	--
Total	2,500.3	--	77.6	53.7	25.8	--	1,232.0	272.7	838.5
Riverborder Unit									
Boone	107.0	1.5	--	2.3	--	--	63.2	4.8	35.2
Callaway	181.3	6.6	--	--	--	--	67.4	11.8	95.5
Cape Girardeau	94.5	--	--	--	--	2.5	67.4	8.8	15.8
Cole	71.1	--	--	2.1	--	--	30.5	--	38.5
Dunklin	21.8	--	--	11.1	3.0	--	4.9	--	2.8
Franklin	248.3	--	--	9.6	--	--	87.3	20.3	131.1
Gasconade	139.9	--	--	--	--	--	66.1	4.6	69.2
Howard	60.4	--	--	6.8	--	--	34.0	--	19.6
Jefferson	222.5	--	--	4.5	--	--	44.7	43.5	129.8
Mississippi	13.7	--	--	--	--	--	5.9	1.0	6.8
Moniteau	54.6	--	--	--	--	--	40.5	--	14.1
Montgomery	98.5	--	--	5.8	--	--	31.4	2.9	58.4
New Madrid	18.9	--	--	5.5	--	--	6.5	4.6	2.3
Osage	141.7	--	1.7	--	--	--	73.7	--	66.3
Pemiscot	11.3	--	--	1.9	2.8	--	6.6	--	--
Perry	116.6	--	--	--	--	5.2	64.5	--	46.9
St. Charles	83.8	--	--	15.0	--	--	8.2	14.2	46.4
St. Louis	31.9	--	--	--	1.3	--	--	25.2	5.4
Ste. Genevieve	177.3	9.9	--	--	--	--	85.8	19.0	62.6
Scott	19.1	--	--	--	1.3	--	10.2	1.6	6.0
Stoddard	47.8	--	7.2	1.5	--	--	13.0	--	26.1
Warren	130.7	--	--	21.1	--	--	39.3	24.5	45.8
Total	2,092.7	18.0	8.9	87.2	8.4	7.7	851.1	186.8	924.6
All Counties	13,370.8	1,320.9	246.3	402.5	42.2	222.4	5,023.8	928.9	5,183.8

Table 10.--Area of timberland by county and forest type, Missouri, 1989

(In thousand acres)

Unit and County	All types	Forest type											
		Short-leaf pine	Eastern redcedar	Eastern redcedar-hardwood	Shortleaf pine - oak	Post-blackjack oak	Black-scarlet oak	White oak	Oak-gum-cypress	Elm-ash-soft maple	Cotton-wood	Maple-beech	Non-stocked
Eastern Ozarks Unit													
Bollinger	215.5	--	--	--	3.9	29.6	112.7	50.7	--	--	--	18.6	--
Butler	130.7	15.0	--	--	14.2	10.7	65.5	15.1	5.3	3.1	--	1.8	--
Carter	266.4	23.0	--	--	38.5	29.2	107.4	61.9	--	3.2	--	3.2	--
Crawford	321.9	--	1.6	1.6	4.1	81.3	100.8	113.9	--	13.0	--	5.6	--
Dent	302.4	8.2	--	--	33.9	74.7	130.7	52.9	--	--	--	2.0	--
Iron	275.9	4.4	5.0	2.2	9.4	4.2	125.1	116.7	--	--	--	8.9	--
Madison	239.6	10.6	--	7.4	15.2	17.9	101.8	73.0	--	3.4	--	8.4	1.9
Oregon	292.6	1.9	--	--	18.1	62.3	171.2	28.5	--	--	--	8.7	1.9
Reynolds	425.5	10.6	2.2	--	22.5	23.7	229.1	111.4	--	3.3	--	22.7	--
Ripley	269.0	15.2	--	--	5.7	59.3	118.8	43.8	4.4	13.9	--	7.9	--
St. Francois	142.3	--	5.4	12.5	--	25.8	50.2	40.7	--	5.0	--	2.7	--
Shannon	466.5	23.8	--	10.7	38.1	42.9	252.3	96.3	--	--	--	2.4	--
Washington	375.2	11.0	--	14.9	25.7	72.2	111.6	116.0	--	1.8	--	22.0	--
Wayne	386.5	9.4	4.0	1.7	20.0	32.4	221.9	80.8	--	1.7	--	14.6	--
Total	4,110.0	133.1	18.2	51.0	249.3	566.2	1,899.1	1,001.7	9.7	48.4	--	129.5	3.8
Southwest Ozarks Unit													
Barry	201.7	--	10.4	16.1	6.0	23.5	114.9	19.9	--	--	--	10.9	--
Christian	143.5	--	2.7	10.0	--	9.0	71.3	40.9	--	3.5	--	6.1	--
Douglas	300.3	8.5	--	5.6	18.8	79.8	127.2	39.6	--	2.8	--	18.0	--
Howell	277.8	16.3	--	--	11.4	111.3	108.6	27.8	--	--	--	--	2.4
McDonald	184.7	--	--	4.1	--	23.0	116.9	38.7	--	--	--	2.0	--
Newton	97.6	--	--	--	--	35.2	42.8	12.0	--	3.6	--	4.0	--
Ozark	251.0	--	1.9	26.8	24.8	88.6	71.0	20.7	--	6.0	--	8.3	2.9
Stone	125.1	--	11.2	16.4	--	7.2	73.1	13.5	--	--	--	3.7	--
Taney	230.6	2.4	12.8	82.3	--	45.1	57.9	13.4	--	--	--	16.7	--
Texas	412.7	35.3	--	16.0	48.8	101.4	127.7	66.3	--	6.0	--	11.2	--
Webster	118.4	--	11.4	--	--	41.2	39.9	20.9	--		--	5.0	--
Wright	154.8	--	3.3	2.0	--	67.7	44.0	28.6	--	2.0	--	7.2	--
Total	2,498.2	62.5	53.7	179.3	109.8	633.0	995.3	342.3	--	23.9	--	93.1	5.3
Northwest Ozarks Unit													
Benton	188.6	--	--	2.7	--	67.4	83.8	11.3	--	--	--	23.4	--
Camden	235.4	--	6.2	3.7	--	70.9	102.5	50.0	--	--	--	2.1	--
Cedar	84.0	--	--	--	--	51.0	20.3	1.7	1.9	4.8	--	4.3	--
Dallas	136.9	--	--	12.4	--	39.3	59.6	17.9	--	6.2	--	1.5	--
Hickory	83.9	--	2.5	10.7	--	25.1	28.2	6.3	--	5.0	--	6.1	--
Laclede	207.0	6.0	1.1	2.7	1.8	98.2	78.1	16.2	--	--	--	2.9	--
Maries	137.2	3.5	8.8	11.4	--	52.8	25.4	29.3	--	--	--	6.0	--
Miller	173.4	--	5.5	12.7	--	29.3	63.4	52.3	--	10.2	--	--	--
Morgan	172.9	--	2.2	3.4	--	32.4	84.5	50.4	--	--	--	--	--
Phelps	262.9	12.6	8.3	--	2.3	105.3	83.3	47.2	--	--	--	3.9	--
Polk	105.0	--	14.2	13.4	--	34.0	26.9	15.0	--	1.5	--	--	--
Pulaski	220.7	9.9	3.5	2.9	--	43.3	103.9	45.3	--	5.8	--	6.1	--
St. Clair	161.7	--	--	2.0	--	48.3	52.1	30.6	1.6	5.7	--	21.4	--
Total	2,169.6	32.0	52.3	78.0	4.1	697.3	812.0	373.5	3.5	39.2	--	77.7	--

(Table 10 continued on next page)

(Table 10 continued)

Unit and County	All types	Forest type											
		Short-leaf pine	Eastern redcedar	Eastern redcedar-hardwood	Shortleaf pine - oak	Post-blackjack oak	Black-scarlet oak	White oak	Oak-gum-cypress	Elm-ash-soft maple	Cotton-wood	Maple-beech	Non-stocked
Prairie Unit													
Adair	68.5	--	--	--	--	2.7	10.8	42.0	--	2.7	--	10.3	--
Andrew	17.4	--	--	2.2	--	--	0.3	4.0	--	4.0	--	6.9	--
Atchison	16.6	--	--	--	--	--	1.8	--	--	9.4	--	5.4	--
Audrain	34.3	--	--	--	--	--	4.1	5.8	10.0	1.4	--	13.0	--
Barton	38.7	--	--	--	--	12.9	6.1	--	4.7	10.2	--	4.8	--
Bates	60.0	--	--	--	--	--	10.5	1.9	3.1	18.9	--	25.6	--
Buchanan	26.7	--	--	--	--	--	4.9	3.1	--	8.5	--	10.2	--
Caldwell	20.1	--	--	--	--	--	--	--	--	3.6	--	16.5	--
Carroll	40.9	--	--	--	--	2.1	4.4	6.2	--	5.4	--	22.8	--
Cass	51.3	--	--	--	--	4.6	12.0	4.6	2.3	6.5	--	21.3	--
Chariton	51.1	--	--	--	--	1.3	14.8	4.0	8.0	13.5	--	9.5	--
Clark	70.9	--	--	1.9	--	13.5	21.4	17.1	1.7	11.5	--	3.8	--
Clay	22.1	--	--	--	--	--	2.2	7.2	--	4.3	--	8.4	--
Clinton	11.0	--	--	--	--	--	2.6	1.6	--	--	--	6.8	--
Cooper	53.2	--	--	--	--	4.1	19.8	13.2	--	5.0	--	11.1	--
Dade	40.2	--	--	3.5	--	12.5	11.6	6.5	--	0.9	--	3.1	2.1
Daviess	41.4	--	--	--	--	--	6.1	14.2	2.3	12.0	--	6.8	--
De Kalb	11.4	--	--	--	--	--	8.2	--	--	3.2	--	--	--
Gentry	30.4	--	--	--	--	1.7	24.1	1.7	--	2.9	--	--	--
Greene	78.9	--	3.3	7.3	--	16.3	28.7	16.6	--	1.8	--	4.9	--
Grundy	17.2	--	--	--	--	--	--	5.8	--	8.0	--	3.4	--
Harrison	47.9	--	--	--	--	--	18.2	14.1	--	4.2	--	11.4	--
Henry	87.3	--	--	--	--	6.3	23.4	2.4	2.4	24.2	3.5	25.1	--
Holt	27.1	--	--	--	--	--	7.2	3.4	3.4	4.6	2.0	6.5	--
Jackson	38.9	--	--	--	--	--	8.6	8.5	--	7.0	1.3	13.5	--
Jasper	54.9	--	--	--	--	13.6	25.7	--	--	2.2	--	13.4	--
Johnson	66.0	--	--	--	--	12.4	27.1	9.0	1.7	5.1	--	10.7	--
Knox	39.1	--	2.9	--	--	--	8.2	10.8	--	12.9	--	4.3	--
Lafayette	28.9	--	--	--	--	--	20.1	--	--	3.1	--	5.7	--
Lawrence	58.2	--	--	--	--	25.6	17.2	8.3	--	--	--	7.1	--
Lewis	63.1	--	--	--	--	2.3	14.3	28.2	4.6	8.3	--	5.4	--
Lincoln	106.2	--	--	2.0	--	14.5	36.6	42.7	2.8	4.8	2.8	--	--
Linn	32.7	--	--	--	--	--	11.2	4.6	--	11.2	--	5.7	--
Livingston	37.8	--	3.2	--	--	3.8	6.2	7.2	--	6.1	--	11.3	--
Macon	80.2	--	--	--	--	7.0	25.4	17.8	--	18.1	--	11.9	--
Marion	49.8	--	--	--	--	--	20.6	17.8	--	2.5	2.5	6.4	--
Mercer	29.6	--	--	--	--	--	--	20.6	--	7.2	1.8	--	--
Monroe	72.2	--	--	--	--	3.8	17.0	15.4	6.2	4.0	--	25.8	--
Nodaway	35.4	--	--	--	--	--	4.5	7.5	9.9	6.6	5.2	1.7	--
Pettis	58.6	--	2.4	--	--	9.2	19.0	6.8	3.4	6.6	--	8.0	3.2
Pike	112.2	--	--	--	--	4.4	29.4	60.8	--	8.8	--	8.8	--
Platte	45.0	--	--	--	--	--	13.9	10.4	--	3.9	--	16.8	--
Putnam	59.8	--	1.8	--	--	4.2	19.2	15.5	--	--	--	19.1	--
Ralls	61.7	--	--	3.5	--	--	14.0	22.0	--	9.6	--	12.6	--
Randolph	45.1	--	--	--	--	--	22.2	14.4	3.5	--	--	5.0	--
Ray	48.5	--	--	--	--	--	1.9	10.6	--	8.2	1.7	26.1	--

(Table 10 continued on next page)

(Table 10 continued)

Unit and County	All types	Forest type											
		Short-leaf pine	Eastern redcedar	Eastern redcedar-hardwood	Shortleaf pine - oak	Post-blackjack oak	Black-scarlet oak	White oak	Oak-gum-cypress	Elm-ash-soft maple	Cotton-wood	Maple-beech	Non-stocked
Prairie Unit, continued													
Saline	49.4	--	--	--	--	--	19.2	10.6	--	2.5	--	17.1	--
Schuyler	26.2	--	--	--	--	--	10.6	7.7	--	5.5	--	2.4	--
Scotland	30.3	--	--	--	--	--	9.9	8.0	1.7	2.8	--	7.9	--
Shelby	47.8	--	--	--	--	--	11.2	17.4	5.2	7.6	--	6.4	--
Sullivan	50.4	--	--	--	--	2.7	12.6	22.5	--	2.7	--	9.9	--
Vernon	89.1	--	--	--	--	28.7	10.3	4.4	4.3	24.4	--	17.0	--
Worth	18.6	--	--	--	--	--	7.8	--	--	--	--	10.8	--
Total	2,500.3	--	13.6	20.4	--	210.2	687.1	584.9	81.2	348.4	20.8	528.4	5.3
Riverborder Unit													
Boone	107.0	--	2.3	12.6	--	--	29.5	34.8	--	12.7	--	15.1	--
Callaway	181.3	--	--	19.1	--	2.5	68.6	73.2	--	1.7	--	16.2	--
Cape Girardeau	94.5	--	--	--	--	4.4	52.4	18.8	--	10.4	--	8.5	--
Cole	71.1	--	9.0	3.5	--	10.5	5.5	35.1	--	5.5	--	2.0	--
Dunklin	21.8	--	--	--	--	--	4.5	0.6	8.9	6.6	--	--	1.2
Franklin	248.3	--	18.1	24.0	--	64.3	49.0	70.4	--	13.3	--	9.2	--
Gasconade	139.9	--	5.6	10.7	--	40.9	26.1	51.5	--	2.3	--	2.8	--
Howard	60.4	--	--	4.0	--	--	8.1	28.8	--	5.1	--	14.4	--
Jefferson	222.5	--	19.2	30.0	--	59.0	39.5	51.1	--	5.6	--	18.1	--
Mississippi	13.7	--	--	--	--	--	--	--	2.5	11.2	--	--	--
Moniteau	54.6	--	2.0	3.7	--	7.8	11.3	22.0	--	--	--	7.8	--
Montgomery	98.5	--	--	11.4	--	9.7	30.5	38.9	--	--	--	5.1	2.9
New Madrid	18.9	--	--	--	--	--	--	--	--	16.6	--	2.3	--
Osage	141.7	--	8.0	13.2	--	30.2	25.5	55.1	--	3.9	--	5.8	--
Pemiscot	11.3	--	--	--	--	--	--	--	--	8.5	2.8	--	--
Perry	116.6	5.2	7.2	5.2	--	13.4	36.8	22.8	--	10.4	--	15.6	--
St. Charles	83.8	--	8.2	3.0	--	11.2	20.2	24.0	--	4.1	3.0	10.1	--
St. Louis	31.9	--	--	--	--	5.4	3.6	18.0	--	1.3	--	3.6	--
Ste. Genevieve	177.3	--	7.6	19.8	7.6	55.0	59.3	19.0	--	8.8	--	0.2	--
Scott	19.1	--	--	--	--	--	5.6	4.9	--	7.3	--	1.3	--
Stoddard	47.8	--	--	--	--	1.5	8.0	12.0	11.5	1.2	--	13.6	--
Warren	130.7	--	--	--	--	8.0	34.7	68.7	--	1.3	2.7	15.3	--
Total	2,092.7	5.2	87.2	160.2	7.6	323.8	518.7	649.7	22.9	137.8	8.5	167.0	4.1
All Counties	13,370.8	232.8	225.0	488.9	370.8	2,430.5	4,912.2	2,952.1	117.3	597.7	29.3	995.7	18.5

Table 11.--Area of timberland by county and stand-size class, Missouri, 1989

(In thousand acres)

Unit and County	All stands	Stand-size class			
		Sawtimber	Poletimber	Seedling & Sapling	Nonstocked
Eastern Ozarks Unit					
Bollinger	215.5	110.7	53.0	51.8	--
Butler	130.7	74.4	42.0	14.3	--
Carter	266.4	112.2	76.4	77.8	--
Crawford	321.9	162.3	75.7	83.9	--
Dent	302.4	136.8	85.3	80.3	--
Iron	275.9	126.6	102.3	47.0	--
Madison	239.6	107.9	72.8	57.0	1.9
Oregon	292.6	132.3	51.7	106.7	1.9
Reynolds	425.5	238.4	97.1	90.0	--
Ripley	269.0	117.0	76.2	75.8	--
St. Francois	142.3	78.1	46.3	17.9	--
Shannon	466.5	213.9	113.1	139.5	--
Washington	375.2	183.1	122.0	70.1	--
Wayne	386.5	190.7	117.2	78.6	--
Total	4,110.0	1,984.4	1,131.1	990.7	3.8
Southwest Ozarks Unit					
Barry	201.7	97.0	59.3	45.4	--
Christian	143.5	72.6	27.9	43.0	--
Douglas	300.3	146.1	92.9	61.3	--
Howell	277.8	107.8	81.6	86.0	2.4
McDonald	184.7	121.1	33.8	29.8	--
Newton	97.6	43.6	42.1	11.9	--
Ozark	251.0	110.0	77.7	60.4	2.9
Stone	125.1	37.6	52.2	35.3	--
Taney	230.6	70.6	84.2	75.8	--
Texas	412.7	173.6	102.8	136.3	--
Webster	118.4	55.3	31.8	31.3	--
Wright	154.8	50.9	55.2	48.7	--
Total	2,498.2	1,086.2	741.5	665.2	5.3
Northwest Ozarks Unit					
Benton	188.6	76.2	80.3	32.1	--
Camden	235.4	152.4	46.8	36.2	--
Cedar	84.0	32.4	29.9	21.7	--
Dallas	136.9	59.1	36.1	41.7	--
Hickory	83.9	34.5	28.0	21.4	--
Laclede	207.0	85.8	80.1	41.1	--
Maries	137.2	63.4	47.7	26.1	--
Miller	173.4	97.5	46.4	29.5	--
Morgan	172.9	79.8	52.9	40.2	--
Phelps	262.9	82.6	95.0	85.3	--
Polk	105.0	38.3	39.3	27.4	--
Pulaski	220.7	96.8	55.5	68.4	--
St. Clair	161.7	67.1	64.0	30.6	--
Total	2,169.6	965.9	702.0	501.7	--
Prairie Unit					
Adair	68.5	23.6	23.8	21.1	--
Andrew	17.4	2.2	4.0	11.2	--
Atchison	16.6	9.0	3.6	4.0	--
Audrain	34.3	19.1	7.4	7.8	--
Barton	38.7	14.2	18.4	6.1	--
Bates	60.0	24.3	15.7	20.0	--
Buchanan	26.7	17.0	7.8	1.9	--
Caldwell	20.1	7.2	12.9	--	--
Carroll	40.9	29.0	10.4	1.5	--
Cass	51.3	29.1	2.1	20.1	--
Chariton	51.1	32.5	16.7	1.9	--
Clark	70.9	35.0	24.9	11.0	--
Clay	22.1	15.9	6.2	--	--
Clinton	11.0	3.2	5.2	2.6	--
Cooper	53.2	30.7	21.4	1.1	--

(Table 11 continued on next page)

(Table 11 continued)

Unit and County	All stands	Stand-size class			
		Sawtimber	Poletimber	Seedling & Sapling	Nonstocked
Prairie Unit, continued					
Dade	40.2	7.5	20.3	10.3	2.1
Daviess	41.4	28.4	9.3	3.7	--
De Kalb	11.4	11.4	--	--	--
Gentry	30.4	14.0	13.5	2.9	--
Greene	78.9	30.8	20.6	27.5	--
Grundy	17.2	14.8	1.2	1.2	--
Harrison	47.9	21.7	16.8	9.4	--
Henry	87.3	46.7	19.0	21.6	--
Holt	27.1	13.9	7.9	5.3	--
Jackson	38.9	12.1	14.7	12.1	--
Jasper	54.9	23.4	26.8	4.7	--
Johnson	66.0	28.1	24.6	13.3	--
Knox	39.1	29.4	9.7	--	--
Lafayette	28.9	9.3	1.9	17.7	--
Lawrence	58.2	29.7	15.5	13.0	--
Lewis	63.1	33.6	18.3	11.2	--
Lincoln	106.2	64.6	30.8	10.8	--
Linn	32.7	17.7	3.8	11.2	--
Livingston	37.8	17.1	13.3	7.4	--
Macon	80.2	33.6	27.9	18.7	--
Marion	49.8	22.8	19.8	7.2	--
Mercer	29.6	24.2	1.8	3.6	--
Monroe	72.2	36.4	28.4	7.4	--
Nodaway	35.4	32.3	--	3.1	--
Pettis	58.6	32.6	11.6	11.2	3.2
Pike	112.2	61.8	26.6	23.8	--
Platte	45.0	25.0	15.4	4.6	--
Putnam	59.8	18.1	16.6	25.1	--
Ralls	61.7	44.1	11.7	5.9	--
Randolph	45.1	21.5	18.6	5.0	--
Ray	48.5	16.2	28.7	3.6	--
Saline	49.4	29.3	9.1	11.0	--
Schuyler	26.2	7.1	11.9	7.2	--
Scotland	30.3	9.1	9.1	12.1	--
Shelby	47.8	24.0	18.6	5.2	--
Sullivan	50.4	24.3	20.6	5.5	--
Vernon	89.1	48.6	27.2	13.3	--
Worth	18.6	16.8	1.8	--	--
Total	2,500.3	1,274.0	753.9	467.1	5.3
Riverborder Unit					
Boone	107.0	52.1	26.5	28.4	--
Callaway	181.3	92.8	66.0	22.5	--
Cape Girardeau	94.5	76.9	13.2	4.4	--
Cole	71.1	40.7	21.6	8.8	--
Dunklin	21.8	20.0	--	0.6	1.2
Franklin	248.3	149.6	73.7	25.0	--
Gasconade	139.9	61.7	65.2	13.0	--
Howard	60.4	35.2	17.1	8.1	--
Jefferson	222.5	116.2	54.2	52.1	--
Mississippi	13.7	13.7	--	--	--
Moniteau	54.6	20.0	24.0	10.6	--
Montgomery	98.5	65.7	29.9	--	2.9
New Madrid	18.9	17.4	--	1.5	--
Osage	141.7	73.6	45.4	22.7	--
Pemiscot	11.3	11.3	--	--	--
Perry	116.6	78.1	20.8	17.7	--
St. Charles	83.8	65.1	18.7	--	--
St. Louis	31.9	31.9	--	--	--
Ste. Genevieve	177.3	121.1	38.9	17.3	--
Scott	19.1	19.1	--	--	--
Stoddard	47.8	28.8	7.0	12.0	--
Warren	130.7	103.1	26.3	1.3	--
Total	2,092.7	1,294.1	548.5	246.0	4.1
All Counties	13,370.8	6,604.6	3,877.0	2,870.7	18.5

Table 12.--Area of timberland by county and potential productivity class, Missouri, 1989

(In thousand acres)

Unit and County	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Eastern Ozarks Unit						
Bollinger	215.5	--	--	2.5	129.4	83.6
Butler	130.7	--	--	3.0	85.3	42.4
Carter	266.4	--	--	12.6	153.7	100.1
Crawford	321.9	--	--	7.2	122.9	191.8
Dent	302.4	--	--	--	142.8	159.6
Iron	275.9	--	--	--	165.2	110.7
Madison	239.6	--	--	3.4	108.3	127.9
Oregon	292.6	--	--	3.6	210.4	78.6
Reynolds	425.5	--	--	15.5	301.4	108.6
Ripley	269.0	--	3.4	9.3	146.9	109.4
St. Francois	142.3	--	--	--	44.9	97.4
Shannon	466.5	--	--	2.4	273.7	190.4
Washington	375.2	--	--	7.5	139.2	228.5
Wayne	386.5	--	--	8.5	243.0	135.0
Total	4,110.0	--	3.4	75.5	2,267.1	1,764.0
Southwest Ozarks Unit						
Barry	201.7	--	--	2.5	124.6	74.6
Christian	143.5	--	--	--	56.8	86.7
Douglas	300.3	--	--	--	185.5	114.8
Howell	277.8	--	--	2.9	176.6	98.3
McDonald	184.7	--	--	3.3	121.0	60.4
Newton	97.6	--	3.6	--	73.7	20.3
Ozark	251.0	--	--	2.8	119.7	128.5
Stone	125.1	--	3.7	--	66.2	55.2
Taney	230.6	--	--	--	63.8	166.8
Texas	412.7	--	--	3.8	164.5	244.4
Webster	118.4	--	--	--	66.3	52.1
Wright	154.8	--	--	7.2	77.4	70.2
Total	2,498.2	--	7.3	22.5	1,296.1	1,172.3
Northwest Ozarks Unit						
Benton	188.6	--	--	--	53.0	135.6
Camden	235.4	--	--	2.1	104.6	128.7
Cedar	84.0	--	--	2.4	40.3	41.3
Dallas	136.9	--	--	1.5	50.4	85.0
Hickory	83.9	--	2.9	--	23.2	57.8
Laclede	207.0	--	--	--	78.7	128.3
Maries	137.2	--	--	4.7	29.8	102.7
Miller	173.4	--	--	6.8	80.5	86.1
Morgan	172.9	--	--	--	53.7	119.2
Phelps	262.9	--	--	1.9	57.8	203.2
Polk	105.0	--	--	--	48.5	56.5
Pulaski	220.7	--	2.9	2.9	94.1	120.8
St. Clair	161.7	--	--	16.1	53.4	92.2
Total	2,169.6	--	5.8	38.4	768.0	1,357.4
Prairie Unit						
Adair	68.5	--	--	8.1	33.9	26.5
Andrew	17.4	--	4.0	0.3	8.7	4.4
Atchison	16.6	--	--	1.8	7.2	7.6
Audrain	34.3	--	1.4	9.1	8.8	15.0
Barton	38.7	--	--	5.2	17.4	16.1
Bates	60.0	--	--	7.7	8.6	43.7
Buchanan	26.7	--	--	3.6	14.0	9.1
Caldwell	20.1	--	3.6	--	3.6	12.9
Carroll	40.9	--	--	10.8	21.4	8.7
Cass	51.3	--	--	5.4	18.0	27.9
Chariton	51.1	2.0	--	11.4	16.2	21.5
Clark	70.9	--	--	5.1	27.2	38.6
Clay	22.1	--	--	--	15.9	6.2
Clinton	11.0	--	--	--	2.6	8.4
Cooper	53.2	--	--	2.5	35.7	15.0

(Table 12 continued on next page)

(Table 12 continued)

Unit and County	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Prairie Unit, continued						
Dade	40.2	--	--	4.0	15.5	20.7
Daviess	41.4	--	--	1.0	28.9	11.5
De Kalb	11.4	--	--	6.6	4.8	--
Gentry	30.4	--	--	--	27.0	3.4
Greene	78.9	--	--	1.8	52.8	24.3
Grundy	17.2	--	3.4	3.4	3.6	6.8
Harrison	47.9	--	--	8.4	25.5	14.0
Henry	87.3	--	--	17.1	43.1	27.1
Holt	27.1	--	--	--	10.0	17.1
Jackson	38.9	2.5	3.5	4.8	19.3	8.8
Jasper	54.9	--	--	1.1	44.6	9.2
Johnson	66.0	--	--	5.1	29.0	31.9
Knox	39.1	--	--	2.9	33.3	2.9
Lafayette	28.9	--	--	12.6	14.4	1.9
Lawrence	58.2	--	--	--	23.5	34.7
Lewis	63.1	--	2.9	5.4	33.6	21.2
Lincoln	106.2	--	--	5.6	44.2	56.4
Linn	32.7	--	2.3	4.9	20.9	4.6
Livingston	37.8	--	--	4.3	18.9	14.6
Macon	80.2	2.6	2.6	19.7	45.0	10.3
Marion	49.8	--	4.3	2.5	23.1	19.9
Mercer	29.6	--	--	7.2	18.8	3.6
Monroe	72.2	1.6	3.8	3.6	30.8	32.4
Nodaway	35.4	--	--	10.4	12.3	12.7
Pettis	58.6	--	--	3.4	14.8	40.4
Pike	112.2	--	6.6	4.4	50.4	50.8
Platte	45.0	--	--	9.2	10.0	25.8
Putnam	59.8	--	1.8	--	24.7	33.3
Ralls	61.7	3.5	--	6.8	35.3	16.1
Randolph	45.1	--	--	3.5	33.1	8.5
Ray	48.5	--	1.7	2.2	17.1	27.5
Saline	49.4	2.5	--	10.4	21.1	15.4
Schuyler	26.2	--	--	7.9	11.4	6.9
Scotland	30.3	--	--	9.5	15.1	5.7
Shelby	47.8	--	2.0	5.2	27.0	13.6
Sullivan	50.4	--	--	--	20.8	29.6
Vernon	89.1	1.6	1.6	13.6	24.0	48.3
Worth	18.6	--	--	--	9.0	9.6
Total	2,500.3	16.3	45.5	279.5	1,175.9	983.1
Riverborder Unit						
Boone	107.0	--	--	13.3	62.4	31.3
Callaway	181.3	--	--	7.5	84.1	89.7
Cape Girardeau	94.5	3.5	--	8.5	78.1	4.4
Cole	71.1	--	--	6.1	13.7	51.3
Dunklin	21.8	--	--	6.0	5.7	10.1
Franklin	248.3	--	--	19.7	100.3	128.3
Gasconade	139.9	--	2.3	--	26.9	110.7
Howard	60.4	--	2.8	2.3	43.0	12.3
Jefferson	222.5	--	--	5.6	71.9	145.0
Mississippi	13.7	--	--	8.7	--	5.0
Moniteau	54.6	--	2.1	--	28.5	24.0
Montgomery	98.5	--	--	5.1	42.7	50.7
New Madrid	18.9	--	8.6	7.3	1.5	1.5
Osage	141.7	--	--	1.7	70.3	69.7
Pemiscot	11.3	--	4.7	3.8	2.8	--
Perry	116.6	--	10.4	5.2	54.5	46.5
St. Charles	83.8	--	3.0	10.1	38.2	32.5
St. Louis	31.9	--	--	--	17.5	14.4
Ste. Genevieve	177.3	--	--	--	77.8	99.5
Scott	19.1	--	--	10.4	8.7	--
Stoddard	47.8	13.6	1.2	4.0	16.5	12.5
Warren	130.7	--	--	17.5	52.6	60.6
Total	2,092.7	17.1	35.1	142.8	897.7	1,000.0
All Counties	13,370.8	33.4	97.1	558.7	6,404.8	6,276.8

Table 13.--Area of timberland by county and stocking class of growing-stock trees, Missouri, 1989

(In thousand acres)

Unit and County	All classes	Stocking percent of growing-stock trees				
		Nonstocked	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
Eastern Ozarks Unit						
Bollinger	215.5	--	68.0	111.5	34.0	2.0
Butler	130.7	--	36.4	66.3	19.8	8.2
Carter	266.4	--	41.7	161.0	49.0	14.7
Crawford	321.9	--	108.8	163.0	45.0	5.1
Dent	302.4	1.6	79.4	170.4	43.3	7.7
Iron	275.9	1.7	50.2	179.4	44.6	--
Madison	239.6	3.8	42.2	136.0	54.3	3.3
Oregon	292.6	3.8	85.2	142.7	48.3	12.6
Reynolds	425.5	3.9	98.1	195.4	114.6	13.5
Ripley	269.0	7.1	36.9	131.1	71.0	22.9
St. Francois	142.3	--	64.6	65.1	12.6	--
Shannon	466.5	--	74.1	262.3	122.8	7.3
Washington	375.2	--	105.8	185.7	76.0	7.7
Wayne	386.5	--	82.3	224.0	80.2	--
Total	4,110.0	21.9	973.7	2,193.9	815.5	105.0
Southwest Ozarks Unit						
Barry	201.7	2.5	55.5	119.0	22.7	2.0
Christian	143.5	5.4	62.6	72.1	0.7	2.7
Douglas	300.3	--	109.2	144.8	28.3	18.0
Howell	277.8	2.4	63.3	154.5	41.2	16.4
McDonald	184.7	1.4	86.5	67.4	29.4	--
Newton	97.6	--	37.9	51.1	8.6	--
Ozark	251.0	2.9	72.8	147.2	21.4	6.7
Stone	125.1	--	48.3	74.4	2.4	--
Taney	230.6	--	94.6	119.1	15.2	1.7
Texas	412.7	3.0	112.8	188.3	85.2	23.4
Webster	118.4	--	50.1	53.7	14.6	--
Wright	154.8	2.6	62.9	68.3	21.0	--
Total	2,498.2	20.2	856.5	1,259.9	290.7	70.9
Northwest Ozarks Unit						
Benton	188.6	2.7	74.9	101.2	8.1	1.7
Camden	235.4	6.8	79.5	133.6	12.3	3.2
Cedar	84.0	--	42.1	41.9	--	--
Dallas	136.9	1.5	39.3	82.5	11.1	2.5
Hickory	83.9	2.1	24.0	47.1	10.7	--
Laclede	207.0	--	68.8	104.8	29.1	4.3
Maries	137.2	--	55.8	61.1	17.6	2.7
Miller	173.4	--	64.1	89.5	19.8	--
Morgan	172.9	3.4	68.2	85.9	12.0	3.4
Phelps	262.9	--	47.4	166.3	38.2	11.0
Polk	105.0	--	39.4	50.9	14.7	--
Pulaski	220.7	--	54.8	127.2	29.4	9.3
St. Clair	161.7	8.4	83.7	62.7	6.9	--
Total	2,169.6	24.9	742.0	1,154.7	209.9	38.1
Prairie Unit						
Adair	68.5	--	25.8	29.2	13.5	--
Andrew	17.4	0.3	13.1	4.0	--	--
Atchison	16.6	--	10.8	5.8	--	--
Audrain	34.3	--	17.1	8.9	8.3	--
Barton	38.7	10.0	19.7	9.0	--	--
Bates	60.0	1.5	40.2	18.3	--	--
Buchanan	26.7	1.8	19.8	4.6	0.5	--
Caldwell	20.1	--	12.9	7.2	--	--
Carroll	40.9	--	26.6	14.3	--	--
Cass	51.3	--	25.6	25.7	--	--
Chariton	51.1	--	12.9	28.3	9.9	--
Clark	70.9	4.5	36.4	19.6	10.4	--
Clay	22.1	--	15.6	6.5	--	--
Clinton	11.0	2.6	4.2	4.2	--	--
Cooper	53.2	--	27.7	23.0	2.5	--

(Table 13 continued on next page)

(Table 13 continued)

Unit and County	All classes	Stocking percent of growing stock-trees				
		Nonstocked	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
Prairie Unit, continued						
Dade	40.2	2.1	11.2	22.5	4.4	--
Daviess	41.4	--	13.6	16.2	11.6	--
De Kalb	11.4	--	3.2	1.6	6.6	--
Gentry	30.4	--	15.2	12.3	--	2.9
Greene	78.9	--	21.7	50.0	7.2	--
Grundy	17.2	--	8.0	8.0	1.2	--
Harrison	47.9	--	16.1	21.0	8.6	2.2
Henry	87.3	--	48.7	37.1	--	1.5
Holt	27.1	--	19.8	7.3	--	--
Jackson	38.9	--	22.0	12.3	4.6	--
Jasper	54.9	--	40.2	10.0	4.7	--
Johnson	66.0	1.5	30.9	28.4	3.5	1.7
Knox	39.1	--	24.5	14.6	--	--
Lafayette	28.9	--	12.3	16.6	--	--
Lawrence	58.2	--	20.9	29.7	7.6	--
Lewis	63.1	--	12.5	41.9	5.8	2.9
Lincoln	106.2	14.5	32.5	41.2	18.0	--
Linn	32.7	3.0	17.1	12.6	--	--
Livingston	37.8	--	16.0	20.4	1.4	--
Macon	80.2	3.5	19.0	55.1	2.6	--
Marion	49.8	--	13.4	30.4	6.0	--
Mercer	29.6	--	1.8	26.0	1.8	--
Monroe	72.2	1.6	33.8	27.2	9.6	--
Nodaway	35.4	--	28.5	6.9	--	--
Pettis	58.6	3.2	31.6	23.8	--	--
Pike	112.2	--	40.1	55.5	16.6	--
Platte	45.0	2.9	30.4	11.7	--	--
Putnam	59.8	2.1	15.0	33.7	9.0	--
Ralls	61.7	--	29.9	28.3	3.5	--
Randolph	45.1	--	11.7	33.4	--	--
Ray	48.5	--	36.9	9.9	--	1.7
Saline	49.4	--	23.2	26.2	--	--
Schuyler	26.2	--	7.6	16.2	2.4	--
Scotland	30.3	2.4	19.2	8.7	--	--
Shelby	47.8	--	14.8	30.4	2.6	--
Sullivan	50.4	--	21.5	21.7	7.2	--
Vernon	89.1	2.7	52.8	30.9	2.7	--
Worth	18.6	7.4	3.4	7.8	--	--
Total	2,500.3	67.6	1,129.4	1,096.1	194.3	12.9
Riverborder Unit						
Boone	107.0	--	35.4	67.0	4.6	--
Callaway	181.3	--	43.5	91.9	45.9	--
Cape Girardeau	94.5	--	17.5	61.2	15.8	--
Cole	71.1	--	32.1	37.0	2.0	--
Dunklin	21.8	1.2	11.0	5.3	4.3	--
Franklin	248.3	3.5	52.7	176.2	12.4	3.5
Gasconade	139.9	--	29.3	92.9	13.5	4.2
Howard	60.4	--	21.2	27.6	11.6	--
Jefferson	222.5	--	42.7	159.3	15.1	5.4
Mississippi	13.7	3.5	8.4	1.8	--	--
Moniteau	54.6	5.7	17.3	26.7	2.9	2.0
Montgomery	98.5	2.9	28.3	55.8	11.5	--
New Madrid	18.9	1.5	17.4	--	--	--
Osage	141.7	--	49.0	82.3	10.4	--
Pemiscot	11.3	--	5.6	3.8	1.9	--
Perry	116.6	--	23.7	66.9	26.0	--
St. Charles	83.8	--	7.1	58.4	14.2	4.1
St. Louis	31.9	1.3	12.6	10.8	7.2	--
Ste. Genevieve	177.3	3.8	47.8	105.4	19.8	0.5
Scott	19.1	--	2.6	14.5	2.0	--
Stoddard	47.8	1.5	11.7	20.3	14.3	--
Warren	130.7	--	32.5	73.5	22.0	2.7
Total	2,092.7	24.9	549.4	1,238.6	257.4	22.4
All Counties	13,370.8	159.5	4,251.0	6,943.2	1,767.8	249.3

Table 14.--Area of timberland by ownership class, stocking class of growing-stock trees, and Forest Survey Unit, Missouri, 1989

(In thousand acres)

Unit and County	All classes	Stocking percent of growing stock trees				
		Nonstocked	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
All Units						
National forest	1,320.9	--	127.7	781.6	326.3	85.3
Miscellaneous federal	246.3	2.7	98.2	112.4	29.5	3.5
State	402.5	4.5	105.7	210.6	78.9	2.8
County and municipal	42.2	2.5	23.0	11.9	4.8	--
Forest industry	222.4	3.0	57.5	106.0	55.9	--
Farmer	5,023.8	70.6	1,895.4	2,511.5	472.2	74.1
Misc. private corporation	928.9	17.9	290.9	480.6	119.1	20.4
Misc. private individual	5,183.8	58.3	1,652.6	2,728.6	681.1	63.2
All owners	13,370.8	159.5	4,251.0	6,943.2	1,767.8	249.3
Eastern Ozarks Unit						
National forest	873.8	--	69.1	505.2	238.4	61.1
Miscellaneous federal	41.1	--	14.9	13.6	12.6	--
State	197.1	--	45.0	114.1	35.2	2.8
County and municipal	--	--	--	--	--	--
Forest industry	184.3	--	52.4	95.0	36.9	--
Farmer	934.9	10.3	270.5	509.0	135.5	9.6
Misc. private corporation	289.4	--	88.0	144.8	53.7	2.9
Misc. private individual	1,589.4	11.6	433.8	812.2	303.2	28.6
All owners	4,110.0	21.9	973.7	2,193.9	815.5	105.0
Southwest Ozarks Unit						
National forest	294.0	--	47.3	173.8	51.3	21.6
Miscellaneous federal	16.7	--	2.9	13.8	--	--
State	38.1	--	12.1	21.8	4.2	--
County and municipal	5.1	--	--	5.1	--	--
Forest industry	30.4	3.0	2.6	11.0	13.8	--
Farmer	1,205.2	10.7	456.1	586.3	118.9	33.2
Misc. private corporation	86.1	--	24.0	49.2	9.2	3.7
Misc. private individual	822.6	6.5	311.5	398.9	93.3	12.4
All owners	2,498.2	20.2	856.5	1,259.9	290.7	70.9
Northwest Ozarks Unit						
National forest	135.1	--	7.3	89.1	36.6	2.1
Miscellaneous federal	102.0	2.7	39.0	48.1	8.7	3.5
State	26.4	--	5.0	10.4	11.0	--
County and municipal	2.9	--	2.9	--	--	--
Forest industry	--	--	--	--	--	--
Farmer	800.6	5.8	300.7	422.1	56.4	15.6
Misc. private corporation	93.9	--	38.8	38.8	12.0	4.3
Misc. private individual	1,008.7	16.4	348.3	546.2	85.2	12.6
All owners	2,169.6	24.9	742.0	1,154.7	209.9	38.1
Prairie Unit						
National forest	--	--	--	--	--	--
Miscellaneous federal	77.6	--	38.5	35.4	3.7	--
State	53.7	4.5	27.3	16.0	5.9	--
County and municipal	25.8	--	15.5	6.8	3.5	--
Forest industry	--	--	--	--	--	--
Farmer	1,232.0	26.8	615.7	501.7	80.3	7.5
Misc. private corporation	272.7	16.9	100.5	136.6	18.7	--
Misc. private individual	838.5	19.4	331.9	399.6	82.2	5.4
All owners	2,500.3	67.6	1,129.4	1,096.1	194.3	12.9
Riverborder Unit						
National forest	18.0	--	4.0	13.5	--	0.5
Miscellaneous federal	8.9	--	2.9	1.5	4.5	--
State	87.2	--	16.3	48.3	22.6	--
County and municipal	8.4	2.5	4.6	--	1.3	--
Forest industry	7.7	--	2.5	--	5.2	--
Farmer	851.1	17.0	252.4	492.4	81.1	8.2
Misc. private corporation	186.8	1.0	39.6	111.2	25.5	9.5
Misc. private individual	924.6	4.4	227.1	571.7	117.2	4.2
All owners	2,092.7	24.9	549.4	1,238.6	257.4	22.4

Table 15.--Area of timberland by forest type, ownership class and Forest Survey Unit, Missouri, 1989

(In thousand acres)

Forest type	All owners	Ownership class							
		National forest	Misc. federal	State	County & municipal	Forest industry	Farmer	Misc. private corporation	Misc. private individual
All Units									
Shortleaf pine	232.8	133.0	3.5	16.7	--	10.2	35.2	6.3	27.9
Eastern redcedar	225.0	4.0	1.6	4.1	--	--	97.7	13.9	103.7
E. redcedar-hardwood	488.9	26.4	11.1	9.1	--	--	213.0	34.9	194.4
Shortleaf pine-oak	370.8	140.3	--	13.7	--	25.1	81.3	5.6	104.8
Post-blackjack oak	2,430.5	108.2	38.3	32.3	2.6	32.4	992.2	141.1	1,083.4
Black-scarlet oak	4,912.2	564.4	71.4	193.1	13.7	115.5	1,638.8	337.2	1,978.1
White oak	2,952.1	314.5	48.2	64.8	9.7	33.7	1,080.6	193.8	1,206.8
Oak-gum-cypress	117.3	--	9.4	13.5	--	--	51.2	9.1	34.1
Elm-ash-soft maple	597.7	--	37.9	28.7	9.7	2.5	315.6	65.0	138.3
Cottonwood	29.3	--	2.8	--	2.8	--	14.1	1.3	8.3
Maple-beech	995.7	30.1	22.1	26.5	2.5	3.0	492.1	120.7	298.7
Nonstocked	18.5	--	--	--	1.2	--	12.0	--	5.3
All types	13,370.8	1,320.9	246.3	402.5	42.2	222.4	5,023.8	928.9	5,183.8
Eastern Ozarks Unit									
Shortleaf pine	133.1	81.9	--	10.8	--	4.8	13.7	6.3	15.6
Eastern redcedar	18.2	--	1.6	--	--	--	4.9	4.0	7.7
E. redcedar-hardwood	51.0	2.3	3.5	--	--	--	26.4	5.7	13.1
Shortleaf pine-oak	249.3	97.0	--	10.9	--	14.5	36.4	5.6	84.9
Post-blackjack oak	566.2	54.3	--	12.4	--	32.4	167.4	29.0	270.7
Black-scarlet oak	1,899.1	402.6	11.7	115.5	--	104.5	357.5	139.6	767.7
White oak	1,001.7	224.1	11.8	42.0	--	28.1	245.3	77.2	373.2
Oak-gum-cypress	9.7	--	--	3.1	--	--	4.4	--	2.2
Elm-ash-soft maple	48.4	--	7.5	--	--	--	26.4	1.6	12.9
Cottonwood	--	--	--	--	--	--	--	--	--
Maple-beech	129.5	11.6	5.0	2.4	--	--	48.7	20.4	41.4
Nonstocked	3.8	--	--	--	--	--	3.8	--	--
All types	4,110.0	873.8	41.1	197.1	--	184.3	934.9	289.4	1,589.4
Southwest Ozarks Unit									
Shortleaf pine	62.5	26.1	--	2.4	--	5.4	21.5	--	7.1
Eastern redcedar	53.7	4.0	--	4.1	--	--	28.1	4.3	13.2
E. redcedar-hardwood	179.3	24.1	--	5.1	--	--	81.5	6.1	62.5
Shortleaf pine-oak	109.8	39.2	--	2.8	--	10.6	37.3	--	19.9
Post-blackjack oak	633.0	34.1	2.8	13.6	2.6	--	327.0	16.1	236.8
Black-scarlet oak	995.3	96.7	8.7	8.1	2.5	5.8	478.5	36.2	358.8
White oak	342.3	52.5	5.2	--	--	5.6	142.6	19.4	117.0
Oak-gum-cypress	--	--	--	--	--	--	--	--	--
Elm-ash-soft maple	23.9	--	--	--	--	--	23.9	--	--
Cottonwood	--	--	--	--	--	--	--	--	--
Maple-beech	93.1	17.3	--	2.0	--	3.0	61.9	4.0	4.9
Nonstocked	5.3	--	--	--	--	--	2.9	--	2.4
All types	2,498.2	294.0	16.7	38.1	5.1	30.4	1,205.2	86.1	822.6

(Table 15 continued on next page)

(Table 15 continued)

Forest type	All owners	Ownership class: National forest	Misc. federal	State	County & municipal	Forest industry	Farmer	Misc. private corporation	Misc. private individual
Northwest Ozarks Unit									
Shortleaf pine	32.0	25.0	3.5	3.5	--	--	--	--	--
Eastern redcedar	52.3	--	--	--	--	--	27.3	--	25.0
E. redcedar-hardwood	78.0	--	4.1	--	--	--	32.4	3.6	37.9
Shortleaf pine-oak	4.1	4.1	--	--	--	--	--	--	--
Post-blackjack oak	697.3	19.8	29.3	--	--	--	293.4	20.8	334.0
Black-scarlet oak	812.0	52.9	26.5	22.9	--	--	269.0	40.3	400.4
White oak	373.5	33.3	20.1	--	2.9	--	120.5	14.5	182.2
Oak-gum-cypress	3.5	--	--	--	--	--	1.6	--	1.9
Elm-ash-soft maple	39.2	--	9.4	--	--	--	16.5	3.4	9.9
Cottonwood	--	--	--	--	--	--	--	--	--
Maple-beech	77.7	--	9.1	--	--	--	39.9	11.3	17.4
Nonstocked	--	--	--	--	--	--	--	--	--
All types	2,169.6	135.1	102.0	26.4	2.9	--	800.6	93.9	1,008.7
Prairie Unit									
Shortleaf pine	--	--	--	--	--	--	--	--	--
Eastern redcedar	13.6	--	--	--	--	--	3.2	3.3	7.1
E. redcedar-hardwood	20.4	--	3.5	--	--	--	9.5	--	7.4
Shortleaf pine-oak	--	--	--	--	--	--	--	--	--
Post-blackjack oak	210.2	--	6.2	6.3	--	--	99.0	30.6	68.1
Black-scarlet oak	687.1	--	24.5	14.0	8.7	--	323.3	73.4	243.2
White oak	584.9	--	11.1	13.1	6.8	--	302.2	33.7	218.0
Oak-gum-cypress	81.2	--	3.4	--	--	--	43.7	9.1	25.0
Elm-ash-soft maple	348.4	--	18.1	7.7	7.8	--	175.0	47.2	92.6
Cottonwood	20.8	--	2.8	--	--	--	11.4	1.3	5.3
Maple-beech	528.4	--	8.0	12.6	2.5	--	259.4	74.1	171.8
Nonstocked	5.3	--	--	--	--	--	5.3	--	--
All types	2,500.3	--	77.6	53.7	25.8	--	1,232.0	272.7	838.5
Riverborder Unit									
Shortleaf pine	5.2	--	--	--	--	--	--	--	5.2
Eastern redcedar	87.2	--	--	--	--	--	34.2	2.3	50.7
E. redcedar-hardwood	160.2	--	--	4.0	--	--	63.2	19.5	73.5
Shortleaf pine-oak	7.6	--	--	--	--	--	7.6	--	--
Post-blackjack oak	323.8	--	--	--	--	--	105.4	44.6	173.8
Black-scarlet oak	518.7	12.2	--	32.6	2.5	5.2	210.5	47.7	208.0
White oak	649.7	4.6	--	9.7	--	--	270.0	49.0	316.4
Oak-gum-cypress	22.9	--	6.0	10.4	--	--	1.5	--	5.0
Elm-ash-soft maple	137.8	--	2.9	21.0	1.9	2.5	73.8	12.8	22.9
Cottonwood	8.5	--	--	--	2.8	--	2.7	--	3.0
Maple-beech	167.0	1.2	--	9.5	--	--	82.2	10.9	63.2
Nonstocked	4.1	--	--	--	1.2	--	--	--	2.9
All types	2,092.7	18.0	8.9	87.2	8.4	7.7	851.1	186.8	924.6

Table 16.--Area of timberland by forest type, stand-size class and Forest Survey Unit, Missouri, 1989

(In thousand acres)

Unit and forest type	All stands	Stand-size class			
		Sawtimber	Poletimber	Seedling & Sapling	Nonstocked
All Units					
Shortleaf pine	232.8	140.3	80.6	11.9	--
Eastern redcedar	225.0	68.5	41.6	114.9	--
E. redcedar-hardwood	488.9	156.4	164.9	167.6	--
Shortleaf pine-oak	370.8	196.4	120.8	53.6	--
Post-blackjack oak	2,430.5	837.3	963.0	630.2	--
Black-scarlet oak	4,912.2	2,485.6	1,356.1	1,070.5	--
White oak	2,952.1	1,769.3	752.9	429.9	--
Oak-gum-cypress	117.3	88.8	25.1	3.4	--
Elm-ash-soft maple	597.7	440.3	97.6	59.8	--
Cottonwood	29.3	29.3	--	--	--
Maple-beech	995.7	392.4	274.4	328.9	--
Nonstocked	18.5	--	--	--	18.5
All types	13,370.8	6,604.6	3,877.0	2,870.7	18.5
Eastern Ozarks Unit					
Shortleaf pine	133.1	93.2	30.7	9.2	--
Eastern redcedar	18.2	11.2	--	7.0	--
E. redcedar-hardwood	51.0	12.0	20.3	18.7	--
Shortleaf pine-oak	249.3	142.1	74.4	32.8	--
Post-blackjack oak	566.2	215.5	175.4	175.3	--
Black-scarlet oak	1,899.1	946.1	508.5	444.5	--
White oak	1,001.7	498.1	277.6	226.0	--
Oak-gum-cypress	9.7	3.1	6.6	--	--
Elm-ash-soft maple	48.4	38.1	3.3	7.0	--
Cottonwood	--	--	--	--	--
Maple-beech	129.5	25.0	34.3	70.2	--
Nonstocked	3.8	--	--	--	3.8
All types	4,110.0	1,984.4	1,131.1	990.7	3.8
Southwest Ozarks Unit					
Shortleaf pine	62.5	40.7	19.1	2.7	--
Eastern redcedar	53.7	9.2	12.2	32.3	--
E. redcedar-hardwood	179.3	27.4	80.5	71.4	--
Shortleaf pine-oak	109.8	44.4	44.6	20.8	--
Post-blackjack oak	633.0	253.3	191.4	188.3	--
Black-scarlet oak	995.3	485.0	271.6	238.7	--
White oak	342.3	187.1	91.5	63.7	--
Oak-gum-cypress	--	--	--	--	--
Elm-ash-soft maple	23.9	20.1	3.8	--	--
Cottonwood	--	--	--	--	--
Maple-beech	93.1	19.0	26.8	47.3	--
Nonstocked	5.3	--	--	--	5.3
All types	2,498.2	1,086.2	741.5	665.2	5.3

(Table 16 continued on next page)

(Table 16 continued)

Unit and forest type	All stands	Stand-size class			
		Sawtimber	Poletimber	Seedling & Sapling	Nonstocked
Northwest Ozarks Unit					
Shortleaf pine	32.0	6.4	25.6	--	--
Eastern redcedar	52.3	5.4	7.8	39.1	--
E. redcedar-hardwood	78.0	36.5	23.8	17.7	--
Shortleaf pine-oak	4.1	2.3	1.8	--	--
Post-blackjack oak	697.3	202.1	316.0	179.2	--
Black-scarlet oak	812.0	409.2	213.2	189.6	--
White oak	373.5	249.8	80.3	43.4	--
Oak-gum-cypress	3.5	1.6	--	1.9	--
Elm-ash-soft maple	39.2	30.9	4.7	3.6	--
Cottonwood	--	--	--	--	--
Maple-beech	77.7	21.7	28.8	27.2	--
Nonstocked	--	--	--	--	--
All types	2,169.6	965.9	702.0	501.7	--
Prairie Unit					
Shortleaf pine	--	--	--	--	--
Eastern redcedar	13.6	--	5.3	8.3	--
E. redcedar-hardwood	20.4	3.7	3.5	13.2	--
Shortleaf pine-oak	--	--	--	--	--
Post-blackjack oak	210.2	45.5	118.2	46.5	--
Black-scarlet oak	687.1	343.0	202.1	142.0	--
White oak	584.9	335.1	184.9	64.9	--
Oak-gum-cypress	81.2	65.2	16.0	--	--
Elm-ash-soft maple	348.4	228.3	80.0	40.1	--
Cottonwood	20.8	20.8	--	--	--
Maple-beech	528.4	232.4	143.9	152.1	--
Nonstocked	5.3	--	--	--	5.3
All types	2,500.3	1,274.0	753.9	467.1	5.3
Riverborder Unit					
Shortleaf pine	5.2	--	5.2	--	--
Eastern redcedar	87.2	42.7	16.3	28.2	--
E. redcedar-hardwood	160.2	76.8	36.8	46.6	--
Shortleaf pine-oak	7.6	7.6	--	--	--
Post-blackjack oak	323.8	120.9	162.0	40.9	--
Black-scarlet oak	518.7	302.3	160.7	55.7	--
White oak	649.7	499.2	118.6	31.9	--
Oak-gum-cypress	22.9	18.9	2.5	1.5	--
Elm-ash-soft maple	137.8	122.9	5.8	9.1	--
Cottonwood	8.5	8.5	--	--	--
Maple-beech	167.0	94.3	40.6	32.1	--
Nonstocked	4.1	--	--	--	4.1
All types	2,092.7	1,294.1	548.5	246.0	4.1

Table 17.--Number of all live trees on timberland by species group and diameter class, Missouri, 1989

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods													
White pine	1,677	--	285	296	350	208	364	146	28	--	--	--	--
Shortleaf pine	162,582	37,653	35,782	35,709	24,195	14,686	8,435	4,165	1,390	409	148	9	1
Other yellow pines	425	75	75	--	171	104	--	--	--	--	--	--	--
Baldcypress	479	120	--	84	27	27	--	30	39	58	16	74	4
Eastern redcedar	383,415	226,326	88,530	39,635	17,570	6,961	2,695	1,195	362	105	20	16	--
Other softwoods	303	141	--	49	113	--	--	--	--	--	--	--	--
Total	548,881	264,315	124,672	75,773	42,426	21,986	11,494	5,536	1,819	572	184	99	5
Hardwoods													
Select white oak	866,686	337,786	187,552	115,044	74,834	56,631	37,981	25,845	15,650	7,935	3,545	3,543	340
Other white oak	656,030	257,843	156,127	98,740	63,496	34,795	20,851	12,413	6,598	2,737	1,301	1,079	50
Select red oak	89,363	27,831	18,500	9,669	7,839	7,503	6,474	4,076	3,112	1,904	1,033	1,260	162
Other red oak	1,160,175	504,370	240,238	141,338	95,356	68,204	46,491	30,762	16,914	8,091	4,020	4,065	326
Select hickory	424,279	243,789	82,175	46,818	25,627	12,651	6,857	3,390	1,725	679	280	273	15
Other hickory	673,029	436,894	131,427	51,027	26,900	14,049	7,387	3,276	1,323	476	199	71	--
Basswood	9,562	5,539	1,806	529	442	479	222	230	128	65	54	61	7
Beech	811	639	102	26	--	--	5	7	14	6	3	7	2
Hard maple	150,962	103,390	26,774	9,439	5,069	2,942	1,558	973	407	201	115	80	14
Soft maple	132,178	95,846	18,608	7,361	2,820	2,460	1,608	1,152	612	683	329	569	130
Elm	639,926	447,698	119,357	44,095	16,766	6,512	3,196	1,345	511	230	74	139	3
Ash	213,252	126,721	42,353	20,810	10,674	5,379	3,713	1,883	950	380	195	181	13
Sycamore	23,766	8,772	4,358	2,192	2,061	1,642	1,544	912	669	665	303	544	104
Cottonwood	6,432	1,632	472	365	571	531	528	574	341	262	250	620	286
Willow	16,317	7,417	1,679	2,103	1,287	631	974	797	556	392	244	229	8
Hackberry	114,494	71,112	18,532	11,892	5,265	3,363	1,921	1,269	505	317	167	135	16
Aspen	112	81	--	--	--	31	--	--	--	--	--	--	--
Birch	7,226	1,836	1,315	1,366	890	731	414	251	180	105	45	77	16
Sweetgum	4,209	2,073	944	401	206	363	75	16	79	19	22	11	--
Tupelo	121,689	95,832	16,695	4,303	1,841	1,010	859	538	244	178	90	94	5
Black cherry	80,643	54,864	15,193	5,546	2,751	1,225	506	251	162	91	24	30	--
Black walnut	83,025	26,459	16,538	11,668	11,550	7,512	4,356	2,486	1,376	689	222	162	7
Butternut	2,042	981	577	231	39	48	119	16	22	5	4	--	--
Yellow-poplar	1,311	864	195	24	95	25	68	19	3	3	10	1	4
Persimmon	101,747	75,478	19,766	5,162	1,076	175	52	29	--	9	--	--	--
Sassafras	219,698	187,332	25,070	5,557	1,209	276	151	47	14	29	--	13	--
Other hardwoods	694,059	535,420	109,740	24,752	9,876	6,603	3,645	1,713	1,072	588	316	308	26
Noncommercial sp.	297,658	237,129	42,031	12,103	3,919	1,513	473	225	102	78	30	50	5
Total	6,790,681	3,895,628	1,298,124	632,561	372,459	237,284	152,028	94,495	53,269	26,817	12,875	13,602	1,539
All species	7,339,562	4,159,943	1,422,796	708,334	414,885	259,270	163,522	100,031	55,088	27,389	13,059	13,701	1,544

Table 18.--Number of growing-stock trees on timberland by species group and diameter class, Missouri, 1989

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods													
White pine	1,677	--	285	296	350	208	364	146	28	--	--	--	--
Shortleaf pine	155,772	37,133	33,882	33,537	22,828	14,391	8,116	3,975	1,365	393	148	3	1
Other yellow pines	410	75	75	--	171	89	--	--	--	--	--	--	--
Baldcypress	378	120	--	36	27	16	--	19	23	52	12	69	4
Eastern redcedar	366,595	226,126	83,312	34,662	14,286	5,302	1,873	751	185	83	8	7	--
Other softwoods	254	141	--	--	113	--	--	--	--	--	--	--	--
Total	525,086	263,595	117,554	68,531	37,775	20,006	10,353	4,891	1,601	528	168	79	5
Hardwoods													
Select white oak	715,234	318,961	156,695	88,976	52,438	38,566	24,842	17,141	10,047	4,514	1,733	1,265	56
Other white oak	517,314	244,035	122,003	68,720	42,437	20,505	10,656	5,593	2,339	704	244	73	5
Select red oak	67,730	25,571	14,788	6,611	5,699	4,916	4,081	2,493	1,628	894	461	538	50
Other red oak	963,477	497,382	191,004	99,268	65,742	44,493	29,708	18,739	9,840	4,123	1,766	1,325	87
Select hickory	359,509	218,984	68,286	36,448	18,486	8,709	4,535	2,155	1,175	425	156	147	3
Other hickory	588,025	411,121	106,218	35,976	17,874	9,071	4,513	1,966	862	303	85	36	--
Basswood	6,961	5,199	918	149	159	151	90	139	72	36	41	7	--
Beech	640	582	21	26	--	--	5	--	--	4	1	1	--
Hard maple	130,841	100,660	20,190	5,377	2,118	1,232	654	414	122	35	28	8	3
Soft maple	110,571	89,003	12,783	3,642	1,385	1,192	751	644	323	380	170	273	25
Elm	533,853	422,458	80,209	21,028	5,919	2,312	1,165	420	217	88	3	34	--
Ash	161,976	116,902	25,891	8,685	4,488	2,468	1,841	894	486	157	82	72	10
Sycamore	19,517	8,772	3,157	1,673	1,191	1,320	1,079	692	439	515	250	372	57
Cottonwood	5,240	1,632	222	266	468	417	377	463	261	224	213	498	199
Willow	9,487	4,697	1,002	962	719	234	455	479	345	276	177	140	1
Hackberry	93,651	68,518	11,748	6,706	2,692	1,923	913	536	267	206	91	51	--
Aspen	112	81	--	--	--	31	--	--	--	--	--	--	--
Birch	5,608	1,836	624	1,266	580	539	343	213	98	69	14	26	--
Sweetgum	3,724	2,073	743	324	85	323	50	8	72	15	21	10	--
Tupelo	115,775	95,832	14,370	3,090	975	619	423	251	108	72	8	25	2
Black cherry	65,027	53,874	7,799	1,990	598	446	129	62	84	26	12	7	--
Black walnut	50,895	24,279	9,312	5,218	4,584	3,482	1,938	1,179	491	282	94	36	--
Butternut	1,379	981	213	83	39	21	27	--	15	--	--	--	--
Yellow-poplar	1,225	864	195	24	42	9	57	13	3	3	10	1	4
Persimmon	88,087	72,981	12,204	2,452	396	37	--	17	--	--	--	--	--
Sassafras	199,906	184,195	13,620	1,617	392	12	58	12	--	--	--	--	--
Other hardwoods	585,898	517,688	54,609	7,585	2,392	1,773	853	462	248	163	71	52	2
Noncommercial sp.	6,945	6,696	249	--	--	--	--	--	--	--	--	--	--
Total	5,408,607	3,495,857	929,073	408,162	231,898	144,801	89,543	54,985	29,542	13,514	5,731	4,997	504
All species	5,933,693	3,759,452	1,046,627	476,693	269,673	164,807	99,896	59,876	31,143	14,042	5,899	5,076	509

Table 19.--Net volume of timber on timberland by class of timber and species group, Missouri, 1989

(In thousand cubic feet)

Class of timber	All species	Species group			
		Pine	Other softwoods	Soft hardwoods	Hard hardwoods
Live trees					
Growing-stock trees					
Sawtimber					
Saw log portion	4,474,659	384,459	84,991	540,349	3,464,860
Upper stem portion	859,718	51,526	12,261	68,424	727,507
Total	5,334,377	435,985	97,252	608,773	4,192,367
Poletimber	3,654,190	198,436	127,731	236,094	3,091,929
All growing-stock trees	8,988,567	634,421	224,983	844,867	7,284,296
Cull trees					
Short-log trees	787,372	3,768	5,756	84,081	693,767
Rough trees					
Sawtimber	1,818,682	5,726	26,201	172,406	1,614,349
Poletimber	1,505,141	7,913	21,917	192,033	1,283,278
Total	3,323,823	13,639	48,118	364,439	2,897,627
Rotten trees					
Sawtimber	632,341	1,045	2,085	70,477	558,734
Poletimber	113,302	1,020	411	11,223	100,648
Total	745,643	2,065	2,496	81,700	659,382
All cull trees	4,856,838	19,472	56,370	530,220	4,250,776
All live trees	13,845,405	653,893	281,353	1,375,087	11,535,072
Salvable dead trees					
Sawtimber	41,872	2,364	407	4,384	34,717
Poletimber	29,712	1,574	1,404	5,048	21,686
Total	71,584	3,938	1,811	9,432	56,403
All classes	13,916,989	657,831	283,164	1,384,519	11,591,475

Table 20.--Net volume of growing stock on timberland by species group and diameter class, Missouri, 1989

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
White pine	13,843	935	1,528	1,836	5,660	3,048	836	--	--	--	--
Shortleaf pine	618,365	77,702	116,914	134,912	125,041	91,390	45,051	18,109	8,814	214	218
Other yellow pines	1,751	--	895	856	--	--	--	--	--	--	--
Baldcypress	12,717	54	63	145	--	389	680	2,338	726	7,325	997
Eastern redcedar	212,266	67,843	59,771	40,582	22,761	13,323	4,595	2,629	358	404	--
Other softwoods	462	--	462	--	--	--	--	--	--	--	--
Total	859,404	146,534	179,633	178,331	153,462	108,150	51,162	23,076	9,898	7,943	1,215
Hardwoods											
Select white oak	2,210,089	202,350	259,577	345,418	359,597	367,169	301,232	180,602	90,098	95,526	8,520
Other white oak	878,686	149,345	195,151	170,343	143,382	111,802	64,542	26,488	11,734	5,356	543
Select red oak	375,435	16,211	30,920	46,539	62,058	54,611	50,286	37,367	24,918	43,210	9,315
Other red oak	2,450,398	223,868	322,599	395,612	429,015	403,553	296,631	165,800	94,659	103,837	14,824
Select hickory	459,721	81,819	92,532	82,401	70,262	50,900	39,765	19,281	9,390	12,820	551
Other hickory	422,871	77,485	88,853	86,060	71,329	47,177	29,854	14,078	4,848	3,187	--
Basswood	14,392	338	935	1,484	1,479	3,185	2,395	1,575	2,373	628	--
Beech	513	62	--	--	104	--	--	202	71	74	--
Hard maple	66,714	13,159	11,600	12,422	10,693	10,324	4,182	1,534	1,644	679	477
Soft maple	123,649	9,224	7,298	12,009	12,205	15,713	10,969	17,034	9,871	24,655	4,671
Elm	124,681	41,074	26,455	18,828	16,110	8,376	6,845	3,517	158	3,318	--
Ash	146,484	18,914	21,991	22,626	27,598	20,330	15,659	6,780	5,048	6,047	1,491
Sycamore	180,928	4,915	7,381	15,016	18,990	18,218	17,203	27,207	17,765	39,255	14,978
Cottonwood	159,145	771	2,722	4,383	6,584	11,676	9,394	10,755	13,168	51,740	47,952
Willow	79,522	2,582	4,521	2,559	7,479	12,203	12,439	13,878	11,198	12,437	226
Hackberry	91,834	13,966	12,384	15,978	12,995	11,498	8,030	8,111	4,981	3,891	--
Aspen	393	--	--	393	--	--	--	--	--	--	--
Birch	29,126	2,806	2,738	4,800	5,192	4,804	2,843	3,075	845	2,023	--
Sweetgum	10,067	624	397	3,243	697	188	2,283	669	1,218	748	--
Tupelo	36,122	6,039	4,008	5,242	5,988	5,580	3,557	2,953	449	1,977	329
Black cherry	18,947	3,881	2,798	3,736	1,754	1,461	2,847	1,072	649	749	--
Black walnut	147,241	11,858	22,137	29,602	26,571	24,502	14,400	11,050	4,792	2,329	--
Butternut	1,264	190	170	147	335	--	422	--	--	--	--
Yellow-poplar	3,923	78	224	101	1,083	367	98	149	682	193	948
Persimmon	6,739	4,485	1,603	308	--	343	--	--	--	--	--
Sassafras	5,717	2,856	1,616	122	836	287	--	--	--	--	--
Other hardwoods	84,562	13,501	10,690	14,950	12,077	9,849	8,088	6,929	4,017	4,165	296
Total	8,129,163	902,401	1,131,300	1,294,322	1,304,413	1,194,116	903,964	560,106	314,576	418,844	105,121
All species	8,988,567	1,048,935	1,310,933	1,472,653	1,457,875	1,302,266	955,126	583,182	324,474	426,787	106,336

Table 21.--Net volume of growing stock in the saw-log portion of sawtimber trees on timberland by species group and diameter class, Missouri, 1989

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
White pine	10,028	1,458	5,000	2,784	786	--	--	--	--
Shortleaf pine	373,728	109,562	110,771	84,353	42,648	17,417	8,553	209	215
Other yellow pines	703	703	--	--	--	--	--	--	--
Baldcypress	12,261	118	--	355	641	2,248	706	7,201	992
Eastern redcedar	72,730	32,866	20,051	12,241	4,326	2,508	345	393	--
Other softwoods	--	--	--	--	--	--	--	--	--
Total	469,450	144,707	135,822	99,733	48,401	22,173	9,604	7,803	1,207
Hardwoods									
Select white oak	1,169,366	--	262,330	300,064	261,903	162,920	83,298	90,566	8,285
Other white oak	285,064	--	100,601	89,289	55,165	23,666	10,761	5,057	525
Select red oak	244,163	--	46,900	45,353	44,270	34,064	23,215	41,243	9,118
Other red oak	1,253,826	--	313,528	330,824	258,511	149,931	87,800	98,742	14,490
Select hickory	163,975	--	49,669	41,127	34,431	17,356	8,689	12,166	537
Other hickory	135,799	--	51,165	38,390	26,012	12,720	4,482	3,030	--
Basswood	10,243	--	1,151	2,683	2,134	1,443	2,230	602	--
Beech	408	--	85	--	--	186	66	71	--
Hard maple	24,096	--	7,873	8,549	3,648	1,388	1,528	648	462
Soft maple	84,204	--	8,988	12,940	9,590	15,428	9,168	23,517	4,573
Elm	30,373	--	11,310	6,633	5,951	3,156	144	3,179	--
Ash	68,128	--	19,913	16,587	13,619	6,127	4,695	5,737	1,450
Sycamore	138,883	--	14,305	15,216	15,303	24,989	16,677	37,657	14,736
Cottonwood	142,981	--	5,173	9,946	8,422	9,926	12,381	49,898	47,235
Willow	60,089	--	5,115	9,710	10,646	12,429	10,272	11,698	219
Hackberry	40,984	--	9,231	9,284	6,921	7,270	4,604	3,674	--
Aspen	--	--	--	--	--	--	--	--	--
Birch	15,315	--	3,625	3,847	2,401	2,754	781	1,907	--
Sweetgum	5,002	--	474	152	1,958	598	1,120	700	--
Tupelo	16,782	--	4,067	4,431	3,066	2,622	411	1,866	319
Black cherry	7,092	--	1,174	1,182	2,471	957	593	715	--
Black walnut	66,622	--	18,368	19,500	12,328	9,859	4,391	2,176	--
Butternut	565	--	212	--	353	--	--	--	--
Yellow-poplar	3,151	--	850	315	88	137	641	188	932
Persimmon	267	--	--	267	--	--	--	--	--
Sassafras	805	--	573	232	--	--	--	--	--
Other hardwoods	37,026	--	8,209	7,758	6,945	6,193	3,703	3,931	287
Total	4,005,209	--	944,889	974,279	786,136	506,119	291,650	398,968	103,168
All species	4,474,659	144,707	1,080,711	1,074,012	834,537	528,292	301,254	406,771	104,375

Table 22.--Net volume of sawtimber on timberland by species group and diameter class, Missouri, 1989

(In thousand board feet) [1]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
White pine	54,123	8,446	26,882	14,696	4,099	--	--	--	--
Shortleaf pine	2,182,900	673,773	642,043	478,988	239,833	97,806	48,113	1,162	1,182
Other yellow pines	4,219	4,219	--	--	--	--	--	--	--
Baldcypress	61,836	607	--	1,740	3,159	11,110	3,506	37,003	4,711
Eastern redcedar	443,037	224,373	117,553	64,983	21,272	11,661	1,517	1,678	--
Other softwoods	--	--	--	--	--	--	--	--	--
Total	2,746,115	911,418	786,478	560,407	268,363	120,577	53,136	39,843	5,893
Hardwoods									
Select white oak	6,663,522	--	1,763,534	1,771,458	1,427,165	839,499	410,537	417,874	33,455
Other white oak	1,795,097	--	710,530	551,501	318,389	129,717	56,957	25,605	2,398
Select red oak	1,389,537	--	307,595	272,890	251,669	186,357	123,415	207,882	39,729
Other red oak	7,435,836	--	2,127,442	2,005,880	1,472,217	817,194	461,423	490,851	60,829
Select hickory	983,474	--	339,671	246,577	192,889	93,641	45,570	62,322	2,804
Other hickory	846,489	--	353,712	234,399	148,507	70,035	24,103	15,733	--
Basswood	57,911	--	7,472	16,037	11,970	7,807	11,620	3,005	--
Beech	2,228	--	527	--	--	997	346	358	--
Hard maple	140,069	--	50,939	49,285	19,951	7,247	7,735	2,948	1,964
Soft maple	410,973	--	53,012	68,804	48,183	74,793	43,148	105,542	17,491
Elm	174,714	--	75,358	38,550	31,100	15,589	679	13,438	--
Ash	384,050	--	124,881	94,181	73,692	32,232	24,089	28,557	6,418
Sycamore	707,601	--	84,745	83,220	80,455	128,885	84,974	185,178	60,144
Cottonwood	728,138	--	31,261	56,498	46,841	54,487	67,591	263,803	207,657
Willow	317,166	--	33,996	55,968	57,259	63,869	50,915	54,318	841
Hackberry	222,899	--	60,361	52,978	36,262	35,663	21,499	16,136	--
Aspen	--	--	--	--	--	--	--	--	--
Birch	85,266	--	23,806	22,014	12,996	13,895	3,758	8,797	--
Sweetgum	26,234	--	3,221	860	10,383	3,044	5,442	3,284	--
Tupelo	94,877	--	27,672	25,649	16,243	13,445	2,020	8,564	1,284
Black cherry	38,837	--	8,132	6,755	12,953	4,893	2,913	3,191	--
Black walnut	398,282	--	127,346	117,740	68,427	52,038	22,309	10,422	--
Butternut	3,494	--	1,568	--	1,926	--	--	--	--
Yellow-poplar	17,282	--	5,280	1,907	518	768	3,508	995	4,306
Persimmon	1,566	--	--	1,566	--	--	--	--	--
Sassafras	5,196	--	3,870	1,326	--	--	--	--	--
Other hardwoods	206,769	--	55,791	45,408	36,993	31,404	17,919	18,083	1,171
Total	23,137,507	--	6,381,722	5,821,451	4,376,988	2,677,499	1,492,470	1,946,886	440,491
All species	25,883,622	911,418	7,168,200	6,381,858	4,645,351	2,798,076	1,545,606	1,986,729	446,384

[1] International 1/4-inch rule.

Table 23.--Net volume of growing stock and sawtimber on timberland by county and major species group, Missouri, 1989

Unit and County	Growing stock					Sawtimber				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet*[1]				
Eastern Ozarks										
Bollinger	158,538	5,072	--	6,837	146,629	439,787	14,573	--	15,356	409,858
Butler	116,203	24,656	--	4,879	86,668	351,975	90,714	--	13,916	247,345
Carter	195,855	53,255	138	5,209	137,253	544,027	178,513	--	19,980	345,534
Crawford	215,261	813	1,165	16,024	197,259	607,439	--	3,168	58,096	546,175
Dent	196,419	25,837	259	3,531	166,792	522,840	83,209	--	8,977	430,654
Iron	231,430	18,881	2,074	2,919	207,556	593,160	78,029	6,399	5,255	503,477
Madison	184,533	23,174	2,489	15,202	143,668	515,444	81,641	7,216	53,090	373,497
Oregon	190,348	20,574	539	4,952	164,283	566,936	78,284	1,959	14,003	472,690
Reynolds	348,910	56,890	1,193	5,689	285,138	1,029,240	224,572	3,713	6,567	794,388
Ripley	214,681	38,476	373	18,352	157,480	667,127	178,044	--	46,767	442,316
St. Francois	98,435	39	4,308	2,920	91,168	297,506	--	6,258	7,153	284,095
Shannon	356,707	64,094	841	3,537	288,235	1,001,356	240,349	1,959	7,523	751,525
Washington	273,757	41,549	6,285	8,276	217,647	725,336	157,047	9,684	24,405	534,200
Wayne	307,198	41,212	2,822	6,585	256,579	872,248	150,459	8,748	14,264	698,777
Total	3,088,275	414,522	22,486	104,912	2,546,355	8,734,421	1,555,434	49,104	295,352	6,834,531
Southwest Ozarks										
Barry	121,634	2,548	7,110	3,393	108,583	322,427	3,503	6,117	3,786	309,021
Christian	81,034	659	1,186	3,378	75,811	232,921	3,413	--	9,173	220,335
Douglas	196,231	29,642	1,465	7,945	157,179	558,644	128,898	1,552	21,660	406,534
Howell	180,266	30,105	720	1,005	148,436	495,889	98,839	526	1,497	395,027
McDonald	109,281	655	701	2,870	105,055	326,252	3,057	2,130	5,112	315,953
Newton	59,388	--	99	2,915	56,374	154,282	--	--	4,904	149,378
Ozark	132,009	17,303	8,849	5,714	100,143	326,617	49,106	16,606	16,582	244,323
Stone	57,385	1,060	4,882	759	50,684	138,035	2,486	5,840	1,685	128,024
Taney	90,793	3,510	20,478	3,328	63,477	189,239	3,910	18,459	8,566	158,304
Texas	241,684	67,471	1,226	6,270	166,717	667,262	250,609	2,755	14,681	399,217
Webster	65,256	--	688	587	63,981	171,950	--	--	--	171,950
Wright	76,930	516	914	3,417	72,083	177,082	--	1,269	6,961	168,852
Total	1,411,891	153,469	48,318	41,581	1,168,523	3,760,600	543,821	55,254	94,607	3,066,918
Northwest Ozarks										
Benton	91,779	--	2,194	3,744	85,841	213,013	--	3,482	11,137	198,394
Camden	131,621	--	2,572	1,333	127,716	413,360	--	10,403	2,545	400,412
Cedar	53,106	--	488	4,538	48,080	122,260	--	--	14,036	108,224
Dallas	78,237	--	1,162	6,056	71,019	218,107	--	1,206	21,387	195,514
Hickory	31,557	--	4,322	4,180	23,055	73,304	--	6,879	16,075	50,350
Laclede	107,300	6,761	1,969	3,085	95,485	236,329	2,639	961	8,123	224,606
Maries	70,887	5,027	3,314	5,795	56,751	170,463	10,957	4,216	9,307	145,983
Miller	102,715	--	3,651	4,279	94,785	298,067	--	5,183	14,652	278,232
Morgan	99,531	--	1,875	1,298	96,358	270,212	--	2,012	5,198	263,002
Phelps	147,140	22,081	2,421	5,237	117,401	320,811	31,111	6,055	20,738	262,907
Polk	54,119	--	5,864	1,988	46,267	121,284	--	2,420	2,386	116,478
Pulaski	116,468	10,053	1,250	12,843	92,322	282,191	19,465	--	43,821	218,905
St. Clair	68,167	--	1,056	7,666	59,445	166,848	--	3,720	25,598	137,530
Total	1,152,627	43,922	32,138	62,042	1,014,525	2,906,249	64,172	46,537	195,003	2,600,537
Prairie Unit										
Adair	41,411	--	--	6,919	34,492	88,668	--	--	21,055	67,613
Andrew	2,778	--	--	1,458	1,320	9,018	--	--	6,497	2,521
Atchison	6,821	--	--	1,991	4,830	20,935	--	--	3,777	17,158
Audrain	31,102	--	--	7,358	23,744	88,783	--	--	25,783	63,000
Barton	16,556	--	244	2,966	13,346	48,809	--	--	10,974	37,835
Bates	20,989	--	--	6,415	14,574	70,748	--	--	21,519	49,229
Buchanan	14,186	--	--	6,151	8,035	48,399	--	--	23,400	24,999
Caldwell	12,824	--	--	7,145	5,679	36,148	--	--	29,362	6,786
Carroll	21,643	--	190	10,886	10,567	58,489	--	--	20,231	38,258
Cass	30,058	--	--	7,646	22,412	106,449	--	--	28,123	78,326
Chariton	47,072	--	--	13,551	33,521	158,009	--	--	36,056	121,953
Clark	40,180	--	694	2,410	37,076	119,151	--	1,512	5,886	111,753
Clay	16,387	--	--	6,697	9,690	57,440	--	--	24,746	32,694
Clinton	5,595	--	--	1,614	3,981	18,863	--	--	5,357	13,506
Cooper	42,253	--	799	10,476	30,978	121,174	--	2,913	35,794	82,467

(Table 23 continued on next page)

(Table 23 continued)

Unit and County	Growing stock					Sawtimber				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet*[1]				
Prairie Unit, cont.										
Dade	19,096	--	446	3,551	15,099	42,116	--	663	9,806	31,64
Daviess	37,197	--	--	13,025	24,172	121,730	--	--	53,119	68,61
De Kalb	13,292	--	--	3,925	9,367	38,591	--	--	12,927	25,66
Gentry	18,057	--	71	1,194	16,792	26,742	--	--	3,726	23,01
Greene	43,565	--	711	2,848	40,006	127,343	--	948	7,879	118,51
Grundy	11,480	--	--	3,168	8,312	34,477	--	--	7,257	27,22
Harrison	34,758	--	--	10,858	23,900	101,752	--	--	38,543	63,20
Henry	40,131	--	314	13,549	26,268	122,038	--	910	38,067	83,06
Holt	9,504	--	--	3,666	5,838	33,028	--	--	14,627	18,40
Jackson	17,392	--	--	7,725	9,667	48,664	--	--	25,071	23,59
Jasper	25,571	--	--	4,795	20,776	79,203	--	--	8,169	71,03
Johnson	38,573	--	--	6,814	31,759	110,849	--	--	20,809	90,04
Knox	25,395	--	568	8,862	15,965	83,204	--	941	32,161	50,10
Lafayette	11,392	--	--	3,919	7,473	34,579	--	--	16,968	17,61
Lawrence	41,377	--	279	1,336	39,762	125,520	--	--	4,950	120,57
Lewis	58,303	--	732	4,105	53,466	171,269	--	2,825	7,867	160,57
Lincoln	87,583	--	320	13,817	73,446	301,463	--	920	59,532	241,01
Linn	14,418	--	--	4,616	9,802	41,025	--	--	13,407	27,61
Livingston	19,555	--	152	5,926	13,477	58,289	--	--	19,069	39,22
Macon	66,790	--	--	30,255	36,535	214,170	--	--	110,219	103,95
Marion	49,420	--	--	16,397	33,023	150,869	--	--	68,207	82,66
Mercer	31,336	--	--	12,233	19,103	127,036	--	--	53,644	73,39
Monroe	44,593	--	--	7,017	37,576	127,652	--	--	18,793	108,85
Nodaway	24,284	--	211	12,845	11,228	75,942	--	--	42,768	33,17
Pettis	34,301	--	348	6,035	27,918	107,963	--	--	17,146	90,81
Pike	82,107	--	362	13,874	67,871	255,225	--	726	49,628	204,87
Platte	22,692	--	--	7,370	15,322	60,262	--	--	22,528	37,73
Putnam	29,577	--	--	2,092	27,485	87,888	--	--	5,132	82,75
Ralls	46,295	--	1,056	12,803	32,436	169,985	--	5,029	43,894	121,06
Randolph	31,839	--	--	3,396	28,443	84,902	--	--	11,091	73,81
Ray	23,762	--	--	13,260	10,502	56,817	--	--	39,083	17,73
Saline	27,801	--	285	8,551	18,965	79,948	--	--	26,794	53,15
Schuyler	11,148	--	--	1,366	9,782	33,647	--	--	3,006	30,64
Scotland	14,206	--	--	4,370	9,836	44,436	--	--	14,940	29,49
Shelby	42,747	--	93	9,059	33,595	141,185	--	500	30,009	110,67
Sullivan	39,153	--	--	9,744	29,409	118,232	--	--	33,752	84,48
Vernon	47,860	--	730	12,084	35,046	153,379	--	--	35,597	117,78
Worth	6,622	--	--	551	6,071	26,303	--	--	--	26,30
Total	1,593,027	--	8,605	394,684	1,189,738	4,868,806	--	17,887	1,318,745	3,532,17
Riverborder Unit										
Boone	61,207	--	2,665	11,999	46,543	175,079	--	10,529	36,253	128,29
Callaway	143,392	--	7,671	7,957	127,764	400,412	--	18,574	19,802	362,03
Cape Girardeau	107,362	--	--	16,102	91,260	411,384	--	--	65,747	345,63
Cole	45,416	--	6,399	9,139	29,878	133,375	--	15,503	31,795	86,07
Dunklin	30,544	--	7,596	11,184	11,764	118,487	--	36,929	36,638	44,92
Franklin	180,014	--	17,775	9,030	153,209	554,062	--	50,560	27,644	475,85
Gasconade	104,890	--	7,402	6,420	91,068	296,894	--	13,262	19,634	263,99
Howard	42,903	--	1,559	6,885	34,459	130,371	--	3,081	19,103	108,18
Jefferson	165,639	1,168	19,680	12,294	132,497	511,837	3,759	55,869	45,544	406,66
Mississippi	22,334	--	3,117	14,072	5,145	96,490	--	15,399	59,690	21,40
Moniteau	30,488	--	1,769	1,287	27,432	73,413	--	4,824	3,768	64,82
Montgomery	78,672	--	4,597	2,268	71,807	227,191	--	13,322	3,955	209,91
New Madrid	19,343	--	--	14,911	4,432	77,970	--	--	61,430	16,54
Osage	93,572	--	6,351	2,458	84,763	254,104	--	14,766	3,467	235,87
Pemiscot	18,029	--	--	17,712	317	74,555	--	--	73,027	1,52
Perry	124,102	3,683	6,653	26,654	87,112	429,797	4,475	24,447	110,204	290,67
St. Charles	108,271	--	8,429	20,650	79,192	373,763	--	27,637	75,839	270,28
St. Louis	33,121	--	--	1,072	32,049	126,078	--	--	4,103	121,97
Ste. Genevieve	118,179	3,814	7,075	4,782	102,508	361,881	15,458	13,952	14,981	317,49
Scott	30,544	--	716	16,382	13,446	125,661	--	3,717	67,042	54,90
Stoddard	48,055	--	1,171	8,067	38,817	171,129	--	5,791	32,107	133,23
Warren	136,670	13,843	2,311	20,323	99,693	489,613	54,123	7,929	84,646	342,91
Total	1,742,747	22,508	113,436	241,648	1,365,155	5,613,546	77,815	336,091	896,419	4,303,22
All Counties	8,988,567	634,421	224,983	844,867	7,284,296	25,883,622	2,241,242	504,873	2,800,126	20,337,38

Table 24.--Net volume of live trees and growing stock on timberland by ownership class and species group, Missouri, 1989

(In thousand cubic feet)

Ownership class	Live trees					Growing-stock trees				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
National forest	1,492,400	302,569	10,688	33,477	1,145,666	1,150,913	296,078	8,200	20,026	826,609
Miscellaneous federal	268,211	7,342	6,121	55,748	199,000	166,608	7,032	4,220	38,406	116,950
State	460,898	45,318	17,963	66,275	331,342	325,970	44,490	15,912	42,583	222,985
County and municipal	39,251	--	--	9,150	30,101	22,203	--	--	6,271	15,932
Forest industry	231,833	35,938	--	3,823	192,072	172,674	35,521	--	2,583	134,570
Farmer	5,102,147	99,077	102,775	702,878	4,197,417	3,170,977	96,088	79,730	429,568	2,565,591
Misc. private corporation	930,518	21,088	19,397	122,165	767,868	588,608	20,182	15,557	72,634	480,235
Misc. private individual	5,320,147	142,561	124,409	381,571	4,671,606	3,390,614	135,030	101,364	232,796	2,921,424
All owners	13,845,405	653,893	281,353	1,375,087	11,535,072	8,988,567	634,421	224,983	844,867	7,284,296

Table 25.--Net volume of sawtimber on timberland by species group and butt log grade, Missouri, 1989

(In thousand board feet) [1]

Species group	All grades	Butt log grade			
		1	2	3	Tie and timber
Softwoods					
White pine	54,123	2,706	541	44,922	5,954
Shortleaf pine	2,182,900	45,064	432,967	1,704,869	--
Other yellow pines	4,219	--	--	4,219	--
Baldcypress	61,836	--	2,462	59,374	--
Eastern redcedar	443,037	--	2,894	440,143[2]	--
Other softwoods	--	--	--	--	--
Total	2,746,115	47,770	438,864	2,253,527	5,954
Hardwoods					
Select white oak	6,663,522	194,915	1,025,055	2,698,369	2,745,183
Other white oak	1,795,097	11,572	100,000	528,744	1,154,781
Select red oak	1,389,537	75,243	131,222	345,468	837,604
Other red oak	7,435,836	56,249	329,961	1,563,376	5,486,250
Select hickory	983,474	21,289	123,312	250,310	588,563
Other hickory	846,489	11,102	87,580	275,323	472,484
Basswood	57,911	--	33,436	11,201	13,274
Beech	2,228	--	--	434	1,794
Hard maple	140,069	--	825	27,084	112,160
Soft maple	410,973	11,300	87,612	165,014	147,047
Elm	174,714	--	21,480	53,999	99,235
Ash	384,050	11,070	135,753	167,031	70,196
Sycamore	707,601	207,459	150,839	233,367	115,936
Cottonwood	728,138	19,960	137,754	281,536	288,888
Willow	317,166	5,677	24,319	137,513	149,657
Hackberry	222,899	--	30,356	83,056	109,487
Aspen	--	--	--	--	--
Birch	85,266	3,326	11,758	20,763	49,419
Sweetgum	26,234	4,970	--	13,157	8,107
Tupelo	94,877	5,551	6,681	34,480	48,165
Black cherry	38,837	3,964	7,321	5,187	22,365
Black walnut	398,282	21,564	73,794	178,170	124,754
Butternut	3,494	--	--	3,494	--
Yellow-poplar	17,282	--	--	17,282	--
Persimmon	1,566	--	--	1,566	--
Sassafras	5,196	--	--	1,292	3,904
Other hardwoods	206,769	--	28,283	23,714	154,772
Total	23,137,507	665,211	2,547,341	7,120,930	12,804,025
All species	25,883,622	712,981	2,986,205	9,374,457	12,809,979

[1] International 1/4-inch rule.

[2] Includes 29,172 thousand board feet of volume from sawtimber-sized, Grade 5 eastern redcedar trees graded for specieal use. (See Log Grades for Eastern Redcedar in the Appendix.)

Table 26.--Average net annual growth of growing stock and sawtimber on timberland by county and species group, Missouri, 1972-1988

Unit and County	Growing stock					Sawtimber				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet*[1]				
Eastern Ozarks										
Bollinger	5,824	254	--	390	5,180	21,999	1,641	--	578	19,780
Butler	3,657	700	--	207	2,750	16,715	4,488	--	915	11,312
Carter	7,346	2,141	--	107	5,098	23,340	9,622	--	705	13,013
Crawford	6,155	59	82	262	5,752	19,715	--	56	1,796	17,863
Dent	6,360	1,165	12	53	5,130	26,723	7,744	--	1,039	17,940
Iron	6,683	353	18	113	6,199	32,091	3,309	436	88	28,258
Madison	6,235	601	98	424	5,112	23,639	2,530	241	1,308	19,560
Oregon	7,344	414	16	41	6,873	24,947	1,669	47	22	23,209
Reynolds	11,739	1,617	13	134	9,975	50,725	9,477	13	-34	41,269
Ripley	6,097	599	15	528	4,955	22,868	4,156	--	1,124	17,588
St. Francois	2,288	2	145	144	1,997	8,396	--	111	64	8,221
Shannon	11,707	1,781	31	81	9,814	38,513	9,767	42	172	28,532
Washington	8,095	1,164	184	94	6,653	31,015	5,015	407	749	24,844
Wayne	9,296	1,328	65	116	7,787	40,536	7,596	310	44	32,586
Total	98,826	12,178	679	2,694	83,275	381,222	67,014	1,663	8,570	303,975
Southwest Ozarks										
Barry	5,067	282	767	219	3,799	16,172	1,512	832	-3	13,831
Christian	2,425	14	76	55	2,280	4,850	76	--	207	4,567
Douglas	6,766	617	128	323	5,698	23,453	4,156	32	590	18,675
Howell	7,206	1,207	37	66	5,896	23,587	4,454	17	-4	19,120
McDonald	3,727	11	19	126	3,571	13,978	45	103	-59	13,889
Newton	1,749	--	4	75	1,670	4,020	--	--	100	3,920
Ozark	5,161	637	423	209	3,892	17,322	3,551	480	282	13,009
Stone	2,050	24	328	44	1,654	9,528	45	283	-175	9,375
Taney	4,734	246	1,116	121	3,251	11,631	117	1,189	1,251	9,074
Texas	8,916	2,730	141	211	5,834	30,711	9,427	153	440	20,691
Webster	1,961	--	22	101	1,838	5,709	--	--	--	5,709
Wright	2,716	8	34	115	2,559	9,130	--	40	376	8,714
Total	52,478	5,776	3,095	1,665	41,942	170,091	23,383	3,129	3,005	140,574
Northwest Ozarks										
Benton	2,929	--	111	82	2,736	8,351	--	83	338	7,930
Camden	3,427	--	99	10	3,318	10,123	--	292	66	9,765
Cedar	1,131	--	16	221	894	2,264	--	--	680	1,584
Dallas	2,092	--	57	112	1,923	10,046	--	36	360	9,650
Hickory	1,168	--	163	104	901	2,688	--	250	422	2,016
Laclede	3,392	307	245	23	2,817	8,940	142	14	989	7,795
Maries	2,550	126	259	156	2,009	5,846	372	130	193	5,151
Miller	2,417	--	184	91	2,142	11,148	--	1,162	327	9,659
Morgan	2,587	--	97	15	2,475	14,863	--	1,070	60	13,733
Phelps	3,749	231	91	204	3,223	11,348	2,649	229	318	8,152
Polk	1,770	--	310	152	1,308	3,801	--	106	40	3,655
Pulaski	3,662	768	104	366	2,424	10,563	736	122	971	8,734
St. Clair	1,871	--	34	323	1,514	6,260	--	75	2,180	4,005
Total	32,745	1,432	1,770	1,859	27,684	106,241	3,899	3,569	6,944	91,829
Prairie Unit										
Adair	1,224	--	--	267	957	3,651	--	--	433	3,218
Andrew	78	--	--	35	43	208	--	--	160	48
Atchison	110	--	--	61	49	384	--	--	198	186
Audrain	1,101	--	--	199	902	3,091	--	--	538	2,553
Barton	287	--	10	79	198	743	--	--	276	467
Bates	273	--	--	106	167	748	--	--	212	536
Buchanan	506	--	--	247	259	1,176	--	--	601	575
Caldwell	86	--	--	-6	92	1,123	--	--	-315	1,438
Carroll	1,044	--	8	776	260	2,701	--	--	1,768	933
Cass	374	--	--	11	363	469	--	--	-155	624
Chariton	2,219	--	--	1,171	1,048	6,052	--	--	3,686	2,366
Clark	762	--	18	27	717	4,783	--	26	50	4,707
Clay	375	--	--	223	152	998	--	--	851	147
Clinton	85	--	--	12	73	390	--	--	68	322
Cooper	1,236	--	106	256	874	2,517	--	21	712	1,784

(Table 26 continued on next page)

[1] International 1/4-inch rule.

(Table 26 continued)

Unit and County	Growing stock					Sawtimber				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoo
	Thousand cubic feet					*Thousand board feet*[1]				
Prairie Unit, cont.										
Dade	628	--	131	75	422	600	--	16	123	46
Daviess	476	--	--	1	475	3,485	--	--	-456	3,94
De Kalb	495	--	--	97	398	5,147	--	--	298	4,84
Gentry	471	--	3	35	433	2,312	--	--	106	2,20
Greene	1,369	--	25	282	1,062	1,631	--	28	151	1,45
Grundy	297	--	--	145	152	1,096	--	--	331	76
Harrison	1,046	--	--	300	746	3,459	--	--	1,224	2,23
Henry	868	--	11	470	387	4,975	--	13	2,261	2,70
Holt	311	--	--	215	96	915	--	--	607	30
Jackson	541	--	--	252	289	521	--	--	119	40
Jasper	731	--	--	290	441	3,544	--	--	228	3,31
Johnson	934	--	--	305	629	3,951	--	--	418	3,53
Knox	340	--	36	-68	372	2,826	--	59	-498	3,26
Lafayette	291	--	--	38	253	1,897	--	--	208	1,68
Lawrence	781	--	10	103	668	2,234	--	--	26	2,20
Lewis	1,627	--	24	487	1,116	5,362	--	88	-121	5,39
Lincoln	1,740	--	7	195	1,538	9,156	--	8	878	8,27
Linn	531	--	--	174	357	939	--	--	298	64
Livingston	705	--	6	356	343	6,189	--	--	3,042	3,14
Macon	1,477	--	--	735	742	5,262	--	--	2,599	2,66
Marion	498	--	--	-105	603	2,136	--	--	-494	2,63
Mercer	570	--	--	213	357	1,658	--	--	659	99
Monroe	1,078	--	-8	176	910	4,973	--	5	981	3,98
Nodaway	363	--	10	152	201	839	--	--	222	61
Pettis	733	--	12	322	399	2,167	--	--	1,418	74
Pike	2,046	--	-8	285	1,769	9,150	--	-44	2,825	6,36
Platte	385	--	--	232	153	622	--	--	352	27
Putnam	687	--	--	57	630	3,091	--	--	688	2,40
Ralls	933	--	27	409	497	3,373	--	92	1,124	2,15
Randolph	907	--	--	102	805	3,717	--	--	398	3,31
Ray	832	--	--	544	288	1,440	--	--	1,234	20
Saline	854	--	19	170	665	3,000	--	--	1,129	1,87
Schuyler	381	--	--	67	314	1,544	--	--	965	57
Scotland	320	--	--	92	228	608	--	--	191	41
Shelby	1,032	--	2	218	812	4,167	--	10	723	3,43
Sullivan	777	--	--	194	583	1,783	--	--	248	1,53
Vernon	988	--	19	336	633	5,304	--	--	1,062	4,24
Worth	203	--	--	40	163	2,823	--	--	--	2,82
Total	39,006	--	468	11,455	27,083	146,930	--	322	34,650	111,95
Riverborder Unit										
Boone	1,540	--	76	388	1,076	4,175	--	283	1,018	2,87
Callaway	6,301	--	181	186	5,934	21,417	--	235	425	20,75
Cape Girardeau	2,899	--	--	553	2,346	16,302	--	--	1,569	14,73
Cole	1,304	--	204	236	864	4,079	--	440	447	3,19
Dunklin	915	--	151	198	566	3,423	--	803	908	1,71
Franklin	4,598	--	701	352	3,545	17,977	--	1,327	1,771	14,87
Gasconade	2,327	--	338	175	1,814	11,737	--	2,264	412	9,06
Howard	1,176	--	104	195	877	7,806	--	171	568	7,06
Jefferson	3,079	21	345	337	2,376	19,121	48	2,192	928	15,95
Mississippi	310	--	25	224	61	1,908	--	145	1,379	38
Moniteau	732	--	117	3	612	1,404	--	204	-125	1,32
Montgomery	1,820	--	158	165	1,497	9,607	--	510	326	8,77
New Madrid	484	--	--	367	117	1,939	--	--	1,396	54
Osage	2,515	--	238	58	2,219	7,624	--	277	34	7,31
Pemiscot	132	--	--	138	-6	1,716	--	--	1,710	6
Perry	2,721	183	141	394	2,003	13,502	224	860	2,238	10,18
St. Charles	2,981	--	335	971	1,675	14,111	--	666	4,709	8,73
St. Louis	1,330	--	--	443	887	6,618	--	--	2,149	4,46
Ste. Genevieve	2,882	95	480	128	2,179	13,965	472	504	383	12,60
Scott	437	--	16	129	292	2,993	--	87	1,866	1,04
Stoddard	1,169	--	23	243	903	4,274	--	122	1,085	3,06
Warren	2,615	658	121	158	1,678	10,177	3,005	332	-88	6,92
Total	44,267	957	3,754	6,041	33,515	195,875	3,749	11,422	25,108	155,59
All Counties	267,322	20,343	9,766	23,714	213,499	1,000,359	98,045	20,105	78,277	803,93

[1] International 1/4-inch rule.

Table 27.--Average annual removals of growing stock and sawtimber on timberland by county and species group, Missouri, 1972-1988

Unit and County	Growing stock					Sawtimber				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet*[1]				
Eastern Ozarks										
Bollinger	2,598	61	--	50	2,487	10,652	319	--	218	10,115
Butler	3,109	468	--	263	2,378	10,791	1,570	--	936	8,285
Carter	3,087	136	--	101	2,850	11,185	420	--	199	10,566
Crawford	1,847	--	--	--	1,847	6,453	--	--	--	6,453
Dent	3,580	--	--	43	3,537	11,697	--	--	--	11,697
Iron	3,502	52	--	88	3,362	10,695	278	--	327	10,090
Madison	2,995	275	--	--	2,720	10,919	1,433	--	--	9,486
Oregon	6,615	645	--	134	5,836	24,555	3,009	--	191	21,355
Reynolds	6,427	603	--	171	5,653	26,632	2,427	--	606	23,599
Ripley	2,764	88	--	127	2,549	10,257	451	--	431	9,375
St. Francois	381	--	--	--	381	1,856	--	--	--	1,856
Shannon	3,744	810	25	218	2,691	13,664	2,618	--	940	10,106
Washington	3,520	475	--	124	2,921	10,856	2,146	--	472	8,238
Wayne	5,619	--	--	28	5,591	23,051	--	--	--	23,051
Total	49,788	3,613	25	1,347	44,803	183,263	14,671	--	4,320	164,272
Southwest Ozarks										
Barry	2,484	1,584	--	--	900	7,383	4,400	--	--	2,983
Christian	215	--	--	--	215	536	--	--	--	536
Douglas	2,152	236	--	--	1,916	7,048	970	--	--	6,078
Howell	2,982	178	--	--	2,804	11,090	924	--	--	10,166
McDonald	694	--	--	--	694	2,711	--	--	--	2,711
Newton	829	--	--	--	829	2,096	--	--	--	2,096
Ozark	1,955	204	--	--	1,751	6,739	1,071	--	--	5,668
Stone	1,859	--	94	--	1,765	3,097	--	--	--	3,097
Taney	2,794	--	84	44	2,666	10,170	--	--	--	10,170
Texas	4,226	973	--	--	3,253	15,010	3,346	--	--	11,664
Webster	969	--	--	--	969	1,477	--	--	--	1,477
Wright	1,677	--	--	221	1,456	5,683	--	--	1,008	4,675
Total	22,836	3,175	178	265	19,218	73,040	10,711	--	1,008	61,321
Northwest Ozarks										
Benton	1,798	--	--	74	1,724	4,201	--	--	332	3,869
Camden	921	--	--	--	921	3,689	--	--	--	3,689
Cedar	435	--	--	215	220	2,061	--	--	1,014	1,047
Dallas	952	--	--	--	952	2,614	--	--	--	2,614
Hickory	961	--	--	--	961	2,544	--	--	--	2,544
Laclede	246	--	--	--	246	843	--	--	--	843
Maries	402	--	--	--	402	404	--	--	--	404
Miller	1,533	--	--	--	1,533	3,030	--	--	--	3,030
Morgan	956	--	--	--	956	3,884	--	--	--	3,884
Phelps	1,273	--	--	--	1,273	2,999	--	--	--	2,999
Polk	469	--	--	--	469	1,309	--	--	--	1,309
Pulaski	1,432	--	30	34	1,368	4,339	--	122	155	4,062
St. Clair	453	--	--	--	453	1,843	--	--	--	1,843
Total	11,831	--	30	323	11,478	33,760	--	122	1,501	32,137
Prairie Unit										
Adair	87	--	--	--	87	370	--	--	--	370
Andrew	--	--	--	--	--	--	--	--	--	--
Atchison	--	--	--	--	--	--	--	--	--	--
Audrain	57	--	--	--	57	204	--	--	--	204
Barton	96	--	--	--	96	468	--	--	--	468
Bates	--	--	--	--	--	--	--	--	--	--
Buchanan	--	--	--	--	--	--	--	--	--	--
Caldwell	--	--	--	--	--	--	--	--	--	--
Carroll	197	--	--	--	197	469	--	--	--	469
Cass	--	--	--	--	--	--	--	--	--	--
Chariton	226	--	--	--	226	1,032	--	--	--	1,032
Clark	1,439	--	--	1,129	310	4,438	--	--	3,377	1,061
Clay	86	--	--	86	--	340	--	--	340	--
Clinton	--	--	--	--	--	--	--	--	--	--
Cooper	136	--	--	--	136	487	--	--	--	487

(Table 27 continued on next page)

[1] International 1/4-inch rule.

(Table 27 continued)

Unit and County	Growing stock					Sawtimber				
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwood
	Thousand cubic feet					*Thousand board feet*[1]				
Prairie Unit, cont.										
Dade	821	--	--	--	821	2,472	--	--	--	2,472
Daviess	--	--	--	--	--	--	--	--	--	--
De Kalb	--	--	--	--	--	--	--	--	--	--
Gentry	--	--	--	--	--	--	--	--	--	--
Greene	122	--	--	--	122	222	--	--	--	222
Grundy	597	--	--	115	482	1,677	--	--	482	1,195
Harrison	80	--	--	--	80	385	--	--	--	385
Henry	244	--	--	--	244	1,162	--	--	--	1,162
Holt	--	--	--	--	--	--	--	--	--	--
Jackson	--	--	--	--	--	--	--	--		--
Jasper	664	--	--	--	664	2,633	--	--		2,633
Johnson	505	--	--	82	423	1,688	--	--	291	1,397
Knox	199	--	--	98	101	936	--	--	450	486
Lafayette	--	--	--	--	--	--	--	--	--	--
Lawrence	256	--	--	--	256	1,060	--	--	--	1,060
Lewis	361	--	--	--	361	1,062	--	--	--	1,062
Lincoln	383	--	--	--	383	1,693	--	--	--	1,693
Linn	185	--	--	--	185	466	--	--	--	466
Livingston	321	--	--	--	321	1,559	--	--	--	1,559
Macon	392	--	--	--	392	1,727	--	--	--	1,727
Marion	810	--	--	78	732	2,841	--	--	221	2,620
Mercer	--	--	--	--	--	--	--	--	--	--
Monroe	228	--	75	--	153	330	--	228	--	102
Nodaway	--	--	--	--	--	--	--	--	--	--
Pettis	178	--	--	62	116	603	--	--	287	316
Pike	375	--	--	--	375	1,470	--	--	--	1,470
Platte	--	--	--	--	--	--	--	--	--	--
Putnam	--	--	--	--	--	--	--	--	--	--
Ralls	728	--	--	331	397	3,526	--	--	1,625	1,901
Randolph	--	--	--	--	--	--	--	--	--	--
Ray	26	--	--	--	26	--	--	--	--	--
Saline	--	--	--	--	--	--	--	--	--	--
Schuyler	--	--	--	--	--	--	--	--	--	--
Scotland	115	--	--	--	115	--	--	--	--	--
Shelby	353	--	--	163	190	1,372	--	--	679	693
Sullivan	--	--	--	--	--	--	--	--	--	--
Vernon	650	--	--	--	650	2,954	--	--	--	2,954
Worth	--	--	--	--	--	--	--	--	--	--
Total	10,917	--	75	2,144	8,698	39,646	--	228	7,752	31,666
Riverborder Unit										
Boone	503	--	38	322	143	2,372	--	115	1,588	669
Callaway	1,490	--	20	25	1,445	3,857	--	--	--	3,857
Cape Girardeau	2,577	--	--	524	2,053	10,718	--	--	2,247	8,471
Cole	130	--	--	--	130	635	--	--	--	635
Dunklin	97	--	--	--	97	308	--	--	--	308
Franklin	3,183	--	94	421	2,668	11,414	--	169	1,497	9,748
Gasconade	773	--	41	39	693	2,890	--	--	180	2,710
Howard	249	--	--	--	249	1,029	--	--	--	1,029
Jefferson	2,103	--	14	--	2,089	8,382	--	--	--	8,382
Mississippi	--	--	--	--	--	600	--	--	--	--
Moniteau	111	--	--	--	111	--	--	--	--	--
Montgomery	791	--	--	137	654	2,975	--	--	505	2,470
New Madrid	132	--	--	132	--	642	--	--	642	--
Osage	1,144	--	--	--	1,144	3,427	--	--	--	3,427
Pemiscot	--	--	--	--	--	--	--	--	--	--
Perry	724	--	45	35	644	2,783	--	176	134	2,473
St. Charles	865	--	--	154	711	1,940	--	--	--	1,940
St. Louis	3,756	--	--	1,394	2,362	15,471	--	--	6,288	9,183
Ste. Genevieve	1,515	--	30	31	1,454	5,947	--	140	103	5,704
Scott	25	--	--	14	11	111	--	--	63	48
Stoddard	247	--	--	74	173	1,028	--	--	305	723
Warren	763	--	--	23	740	3,061	--	--	66	2,995
Total	21,178	--	282	3,325	17,571	79,590	--	600	13,618	64,772
All Counties	116,550	6,788	590	7,404	101,768	408,699	25,382	950	28,199	354,168

[1] International 1/4-inch rule.

Table 28.--Average net annual growth and average annual removals of growing stock on timberland by species group and Forest Survey Unit, Missouri, 1972-1988

(In thousand cubic feet)

Species group	All Units		Eastern Ozarks Unit		Southwest Ozarks Unit		Northwest Ozarks Unit		Prairie Unit		Riverborder Unit	
	Growth	Removals	Growth	Removals	Growth	Removals	Growth	Removals	Growth	Removals	Growth	Removals
Softwoods												
White pine	658	--	--	--	--	--	--	--	--	--	658	--
Shortleaf pine	19,618	6,788	12,138	3,613	5,761	3,175	1,432	--	--	--	287	--
Other yellow pines	55	--	40	--	15	--	--	--	--	--	--	--
Baldcypress	222	--	7	--	--	--	--	--	--	--	215	--
Eastern redcedar	9,544	590	672	25	3,095	178	1,770	30	468	75	3,539	282
Other softwoods	12	--	--	--	--	--	--	--	--	--	12	--
Total	30,109	7,378	12,857	3,638	8,871	3,353	3,202	30	468	75	4,711	282
Hardwoods												
Select white oak	66,249	24,254	29,609	9,161	9,973	3,299	7,663	2,103	7,397	1,900	11,607	7,791
Other white oak	20,473	13,720	5,796	3,534	4,724	4,013	5,321	3,454	1,070	1,076	3,562	1,643
Select red oak	9,066	4,842	2,296	1,450	1,292	1,067	1,724	434	1,985	502	1,769	1,389
Other red oak	79,691	46,725	36,621	26,881	21,175	8,446	9,196	4,921	6,452	2,731	6,247	3,746
Select hickory	11,042	3,317	2,291	1,174	1,543	428	1,166	206	3,842	858	2,200	651
Other hickory	11,553	4,468	5,039	1,673	1,915	1,507	1,327	181	1,945	200	1,327	907
Basswood	320	--	--	--	12	--	--	--	254	--	54	--
Beech	19	--	--	--	--	--	--	--	--	--	19	--
Hard maple	4,691	136	651	55	-18	--	36	--	268	--	3,754	81
Soft maple	5,175	1,276	171	43	149	--	167	--	3,287	1,100	1,401	133
Elm	4,884	1,445	259	451	653	44	478	--	2,359	362	1,135	588
Ash	3,599	1,939	240	361	156	85	371	31	1,464	597	1,368	865
Sycamore	3,730	1,709	1,037	298	311	221	706	289	1,054	435	622	466
Cottonwood	1,913	1,422	49	--	--	--	25	--	813	136	1,026	1,286
Willow	624	71	58	--	--	--	100	--	115	--	351	71
Hackberry	5,360	676	282	--	365	--	312	--	3,330	111	1,071	565
Aspen	10	--	--	--	--	--	--	--	--		10	--
Birch	499	261	65	--	--	--	9	--	204	229	221	32
Sweetgum	421	231	344	134	--	--	--	--	--	--	77	97
Tupelo	523	386	394	329	97	--	44	34	--	--	-12	23
Black cherry	615	188	71	92	92	--	31	--	233	--	188	96
Black walnut	2,378	1,418	-45	254	642	373	624	119	839	531	318	141
Butternut	5	--	11	--	-14	--	-4	--	10	--	2	--
Yellow-poplar	134	--	18	--	--	--	--	--	--	--	116	--
Persimmon	812	180	193	34	95	--	113	--	162	--	249	146
Sassafras	265	122	96	47	46	--	12	29	13	--	98	46
Other hardwoods	3,162	386	423	179	399	--	122	--	1,442	74	776	133
Total	237,213	109,172	85,969	46,150	43,607	19,483	29,543	11,801	38,538	10,842	39,556	20,896
All species	267,322	116,550	98,826	49,788	52,478	22,836	32,745	11,831	39,006	10,917	44,267	21,178

Table 29.--Average net annual growth and average annual removals of sawtimber on timberland by species group and Forest Survey Unit, Missouri, 1972-1988

(In thousand board feet) [1]

Species group	All Units		Eastern Ozarks Unit		Southwest Ozarks Unit		Northwest Ozarks Unit		Prairie Unit		Riverborder Unit	
	Growth	Removals	Growth	Removals	Growth	Removals	Growth	Removals	Growth	Removals	Growth	Removals
Softwoods												
White pine	3,005	--	--	--	--	--	--	--	--	--	3,005	--
Shortleaf pine	94,923	25,382	66,897	14,671	23,383	10,711	3,899	--	--	--	744	--
Other yellow pines	117	--	117	--	--	--	--	--	--	--	--	--
Baldcypress	1,157	--	--	--	--	--	--	--	--	--	1,157	--
Eastern redcedar	18,948	950	1,663	--	3,129	--	3,569	122	322	228	10,265	600
Other softwoods	--	--	--	--	--	--	--	--	--	--	--	--
Total	118,150	26,332	68,677	14,671	26,512	10,711	7,468	122	322	228	15,171	600
Hardwoods												
Select white oak	245,109	86,096	87,365	30,286	36,041	10,035	30,802	6,809	34,749	8,460	56,152	30,506
Other white oak	53,941	37,648	10,781	10,690	10,619	13,012	13,229	6,479	4,044	3,645	15,268	3,822
Select red oak	43,774	20,924	8,142	6,403	4,553	3,945	11,311	2,079	11,394	2,242	8,374	6,255
Other red oak	338,560	175,829	171,678	106,754	76,205	28,248	30,198	15,610	28,014	10,558	32,465	14,659
Select hickory	35,158	9,979	6,475	3,488	5,580	1,846	2,948	393	9,042	1,746	11,113	2,506
Other hickory	33,587	11,160	13,982	3,921	5,265	3,381	617	395	6,190	184	7,533	3,279
Basswood	1,484	--	--	--	139	--	--	--	1,128	--	217	--
Beech	90	--	--	--	--	--	--	--	--	--	90	--
Hard maple	16,233	334	1,567	--	-76	--	56	--	778	--	13,908	334
Soft maple	17,636	3,570	559	--	215	--	2,128	--	10,807	3,109	3,927	461
Elm	4,962	4,296	403	1,347	-251	--	-148	--	2,758	1,356	2,200	1,593
Ash	9,518	5,134	1,028	975	1,023	406	578	--	2,580	1,692	4,309	2,061
Sycamore	19,296	7,807	4,026	1,112	2,217	1,008	3,313	1,346	6,521	2,107	3,219	2,234
Cottonwood	8,753	6,765	256	--	--	--	124	--	3,123	686	5,250	6,079
Willow	7,773	330	364	--	--	--	286	--	1,136	--	5,987	330
Hackberry	13,747	2,551	731	--	524	--	941	--	8,849	494	2,702	2,057
Aspen	--	--	--	--	--	--	--	--	--	--	--	--
Birch	1,673	1,007	55	--	--	--	--	--	1,103	863	515	144
Sweetgum	1,120	936	687	508	--	--	--	--	0	--	433	428
Tupelo	1,043	1,307	301	1,043	29	--	250	155	0	--	463	109
Black cherry	1,855	637	1,121	310	171	--	9	--	297	--	257	327
Black walnut	14,420	4,403	2,008	996	927	448	1,954	284	6,616	2,061	2,915	614
Butternut	68	--	35	--	-39	--	41	--	31	--	--	--
Yellow-poplar	540	--	87	--	--	--	--	--	--	--	453	--
Persimmon	136	157	--	--	--	--	--	--	--	--	136	157
Sassafras	153	88	--	--	67	--	28	88	7	--	51	--
Other hardwoods	11,580	1,409	894	759	370	--	108	--	7,441	215	2,767	435
Total	882,209	382,367	312,545	168,592	143,579	62,329	98,773	33,638	146,608	39,418	180,704	78,390
All species	1,000,359	408,699	381,222	183,263	170,091	73,040	106,241	33,760	146,930	39,646	195,875	78,990

[1] International 1/4-inch rule.

Table 30.--Average net annual growth and average annual removals of growing stock on timberland by ownership class and major species group, Missouri, 1972-1988

(In thousand cubic feet)

Ownership class	Growth					Removals				
		Species group					Species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
National forest	32,337	8,402	330	452	23,153	18,077	4,579	33	175	13,290
Miscellaneous federal	4,096	584	322	825	2,365	1,269	--	--	101	1,168
State	9,273	1,606	501	1,000	6,166	2,613	42	--	627	1,944
County and municipal	945	--	--	580	365	1,714	--	--	1,231	483
Forest industry	6,896	1,347	--	151	5,398	2,797	170	--	204	2,423
Farmer	93,965	3,302	4,221	10,675	75,767	46,683	1,260	401	2,624	42,398
Miscellaneous private corporation	17,302	625	640	2,864	13,173	7,901	--	67	74	7,760
Miscellaneous private individual	102,508	4,477	3,752	7,167	87,112	35,496	737	89	2,368	32,302
All owners	267,322	20,343	9,766	23,714	213,499	116,550	6,788	590	7,404	101,768

Table 31.--Average net annual growth and average annual removals of sawtimber on timberland by ownership class and major species group, Missouri, 1972-1988

(In thousand board feet)[1]

Ownership class	Growth					Removals				
		Species group					Species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
National forest	130,470	42,196	410	1,007	86,857	57,354	15,772	--	275	41,307
Miscellaneous federal	14,109	1,283	294	4,063	8,469	3,508	--	--	199	3,309
State	32,404	6,763	1,606	4,427	19,608	11,556	137	--	2,668	8,751
County and municipal	3,595	--	--	2,704	891	7,666	--	--	5,618	2,048
Forest industry	25,721	6,869	--	607	18,245	12,660	730	--	927	11,003
Farmer	350,935	18,030	6,469	34,963	291,473	156,330	5,559	553	10,047	140,171
Miscellaneous private corporation	60,879	2,016	1,140	8,831	48,892	27,287	--	169	332	26,786
Miscellaneous private individual	382,246	20,888	10,186	21,675	329,497	132,338	3,184	228	8,133	120,793
All owners	1,000,359	98,045	20,105	78,277	803,932	408,699	25,382	950	28,199	354,168

[1] International 1/4-inch rule.

Table 32.--Average annual mortality of growing stock and sawtimber on timberland by species group, Missouri, 1972-1988

Species group	Growing stock	Sawtimber
	Thousand cubic feet	*Thousand board feet* [1]
Softwoods		
White pine	--	--
Shortleaf pine	2,607	6,679
Other yellow pines	7	12
Baldcypress	118	569
Eastern redcedar	731	2,099
Other softwoods	--	--
Total	3,463	9,359
Hardwoods		
Select white oak	5,742	14,947
Other white oak	5,900	11,511
Select red oak	2,824	10,949
Other red oak	28,799	74,719
Select hickory	3,194	7,959
Other hickory	3,571	6,299
Basswood	58	141
Beech	3	5
Hard maple	402	558
Soft maple	1,236	3,799
Elm	5,330	10,030
Ash	1,396	2,792
Sycamore	1,718	6,089
Cottonwood	2,754	12,366
Willow	2,473	8,718
Hackberry	738	1,575
Aspen	--	--
Birch	492	1,342
Sweetgum	176	593
Tupelo	278	687
Black cherry	215	222
Black walnut	1,309	2,760
Butternut	27	64
Yellow-poplar	21	88
Persimmon	205	22
Sassafras	103	96
Other hardwoods	1,227	2,168
Total	70,191	180,499
All species	73,654	189,858

[1] International 1/4-inch rule.

Table 33.--Removals, net annual growth, and inventory of growing stock on timberland, Missouri, 1989, and high removals option projections to 2019

(In million cubic feet)

	Removals			Growth			Inventory		
Year	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
1989	135.9	11.6	124.3	267.3	30.1	237.2	8,988.6	859.4	8,129.2
1999	183.2	19.4	163.8	291.4	34.8	256.6	10,190.5	1,025.0	9,165.5
2009	224.8	25.1	199.7	309.6	38.8	270.8	11,207.2	1,175.8	10,031.4
2019	266.1	30.5	235.6	330.8	43.1	287.7	11,964.3	1,307.0	10,657.3

Table 34.--Removals, net annual growth, and inventory of growing stock on timberland, Missouri, 1989, and low removals option projections to 2019

(In million cubic feet)

	Removals			Growth			Inventory		
Year	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
1989	135.9	11.6	124.3	267.3	30.1	237.2	8,988.6	859.4	8,129.2
1999	147.5	16.7	130.8	299.2	35.5	263.7	10,462.9	1,043.9	9,419.0
2009	179.5	21.1	158.4	332.1	40.9	291.2	12,024.5	1,239.6	10,784.9
2019	213.0	25.0	188.0	375.6	47.8	327.8	13,588.0	1,448.5	12,139.5

Table 35.--Sampling errors for Forest Survey Unit and county totals of volume, average net annual growth, average annual removals, and area of timberland, Missouri, 1989

(In percent)

Unit and County	Area	Growing stock			Sawtimber		
		Volume	Growth[2]	Removals[2]	Volume	Growth[2]	Removals[2]
Eastern Ozarks							
Bollinger	3.15	7.20	11.14	32.74	10.29	13.24	35.73
Butler	4.05	8.41	14.06	29.93	11.50	15.19	35.50
Carter	2.84	6.48	9.92	30.04	9.25	12.85	34.87
Crawford	2.58	6.18	10.84	38.83	8.75	13.98	45.91
Dent	2.66	6.47	10.66	27.89	9.44	12.01	34.10
Iron	2.79	5.96	10.40	28.20	8.86	10.96	35.66
Madison	2.99	6.68	10.77	30.50	9.50	12.77	35.29
Oregon	2.71	6.57	9.92	20.52	9.06	12.43	23.54
Reynolds	2.24	4.86	7.85	20.82	6.73	8.72	22.60
Ripley	2.82	6.19	10.89	31.74	8.35	12.98	36.42
St. Francois	3.88	9.14	17.78	85.50	12.51	21.43	85.61
Shannon	2.14	4.80	7.86	27.27	6.82	10.00	31.55
Washington	2.39	5.48	9.45	28.13	8.01	11.15	35.40
Wayne	2.35	5.17	8.82	22.26	7.31	9.75	24.29
Total	0.72	1.63	2.70	7.48	2.31	3.18	8.62
Southwest Ozarks							
Barry	4.36	8.77	11.24	38.12	13.14	18.93	43.21
Christian	5.17	10.74	16.25	*	15.46	34.57	*
Douglas	3.57	6.90	9.73	40.96	9.98	15.72	44.22
Howell	3.71	7.20	9.43	34.80	10.60	15.68	35.26
McDonald	4.55	9.25	13.11	72.13	13.06	20.36	71.31
Newton	6.26	12.55	19.14	65.99	19.00	37.97	81.09
Ozark	3.91	8.42	11.14	42.97	13.06	18.29	45.23
Stone	5.53	12.77	17.68	44.07	20.08	24.66	66.71
Taney	4.08	10.15	11.63	35.95	17.15	22.32	36.82
Texas	3.05	6.22	8.48	29.23	9.13	13.74	30.30
Webster	5.69	11.97	18.08	61.04	17.99	31.86	96.60
Wright	4.97	11.03	15.36	46.40	17.73	25.20	49.25
Total	1.24	2.57	3.49	12.57	3.85	5.84	13.74
Northwest Ozarks							
Benton	4.92	9.25	12.87	37.56	13.78	20.56	51.95
Camden	4.40	7.72	11.90	52.48	9.90	18.67	55.44
Cedar	7.37	12.16	20.72	76.36	18.20	39.48	74.17
Dallas	5.77	10.02	15.23	51.61	13.62	18.74	65.86
Hickory	7.38	15.77	20.39	51.37	23.50	36.23	66.76
Laclede	4.70	8.55	11.96	*	13.09	19.87	*
Maries	5.77	10.52	13.80	79.43	15.41	24.57	*
Miller	5.13	8.74	14.17	40.67	11.65	17.79	61.17
Morgan	5.14	8.88	13.70	51.51	12.24	15.41	54.03
Phelps	4.17	7.30	11.38	44.63	11.23	17.63	61.49
Polk	6.59	12.04	16.56	73.54	18.27	30.47	93.07
Pulaski	4.55	8.21	11.51	42.08	11.98	18.28	51.12
St. Clair	5.31	10.73	16.11	74.82	15.58	23.74	78.44
Total	1.45	2.61	3.85	14.64	3.73	5.76	18.33
Prairie Unit							
Adair	8.28	15.94	19.25	*	25.49	29.91	*
Andrew	16.42	61.54	76.28	*	79.93	*	*
Atchison	16.81	39.28	64.23	*	52.46	92.24	*
Audrain	11.70	18.39	20.30	*	25.47	32.51	*
Barton	11.01	25.21	39.76	*	34.36	66.31	*
Bates	8.84	22.39	40.77	*	28.54	66.09	*
Buchanan	13.26	27.23	29.95	*	34.50	52.71	*
Caldwell	15.28	28.64	72.64	*	39.92	53.94	*
Carroll	10.71	22.05	20.85	*	31.39	34.78	*
Cass	9.56	18.71	34.83	*	23.26	83.46	*
Chariton	9.58	14.95	14.30	*	19.10	23.23	*
Clark	8.14	16.18	24.40	53.32	21.99	26.14	62.44
Clay	14.57	25.34	34.79	*	31.67	57.22	*
Clinton	20.65	43.37	73.07	*	55.27	91.53	*
Cooper	9.39	15.78	19.16	*	21.81	36.03	*

(Table 35 continued on next page)

[1] * indicates a sampling error over 99.00 percent.

[2] Error figures are for average annual growth and removals.

(Table 35 continued)

Unit and County	Area	Growing stock			Sawtimber		
		Volume	Growth[2]	Removals[2]	Volume	Growth[2]	Removals[2]
Prairie Unit, cont.							
Dade	10.80	23.47	26.88	70.60	36.99	73.79	83.66
Daviess	10.65	16.82	30.88	*	21.76	30.62	*
De Kalb	20.29	28.14	30.28	*	38.64	25.19	*
Gentry	12.42	24.14	31.04	*	46.42	37.59	*
Greene	7.71	15.54	18.21	*	21.27	44.76	*
Grundy	16.52	30.27	39.09	82.79	40.88	54.60	*
Harrison	9.90	17.40	20.83	*	23.80	30.73	*
Henry	7.33	16.19	22.87	*	21.73	25.63	*
Holt	13.16	33.27	38.20	*	41.77	59.75	*
Jackson	10.98	24.60	28.96	*	34.41	79.19	*
Jasper	9.25	20.28	24.92	78.50	26.97	30.36	81.06
Johnson	8.43	16.52	22.04	90.01	22.80	28.76	*
Knox	10.96	20.35	36.53	*	26.31	34.00	*
Lafayette	12.74	30.39	39.49	*	40.82	41.50	*
Lawrence	8.98	15.95	24.11	*	21.42	38.24	*
Lewis	8.62	13.43	16.70	*	18.34	24.68	*
Lincoln	6.65	10.96	16.15	*	13.82	18.89	*
Linn	11.98	27.01	29.23	*	37.48	58.99	*
Livingston	11.14	23.20	25.37	*	31.44	22.98	*
Macon	7.65	12.55	17.53	*	16.40	24.92	*
Marion	9.71	14.59	30.19	71.07	19.54	39.11	78.04
Mercer	12.59	18.32	28.22	*	21.30	44.39	*
Monroe	8.06	15.36	20.52	*	21.24	25.63	*
Nodaway	11.51	20.82	35.36	*	27.54	62.40	*
Pettis	8.95	17.51	24.88	*	23.10	38.83	*
Pike	6.47	11.32	14.89	*	15.02	18.90	*
Platte	10.21	21.53	34.33	*	30.92	72.47	*
Putnam	8.86	18.86	25.70	*	25.60	32.51	*
Ralls	8.72	15.08	22.05	74.97	18.41	31.12	70.05
Randolph	10.20	18.18	22.37	*	26.05	29.65	*
Ray	9.84	21.04	23.35	*	31.84	47.63	*
Saline	9.75	19.45	23.05	*	26.85	33.00	*
Schuyler	13.38	30.72	34.51	*	41.38	46.00	*
Scotland	12.45	27.22	37.66	*	36.01	73.30	*
Shelby	9.91	15.69	20.97	*	20.20	28.00	*
Sullivan	9.65	16.39	24.17	*	22.08	42.81	*
Vernon	7.26	14.83	21.43	79.34	19.38	24.82	76.53
Worth	15.88	39.86	47.28	*	46.80	34.02	*
Total	1.37	2.57	3.41	19.36	3.44	4.72	20.89
Riverborder Unit							
Boone	6.45	14.47	27.27	*	20.76	32.61	*
Callaway	4.95	9.45	13.48	88.54	13.73	14.40	*
Cape Girardeau	6.86	10.92	19.87	67.33	13.54	16.50	78.97
Cole	7.91	16.79	29.63	*	23.78	32.99	*
Dunklin	14.29	20.48	35.37	*	25.23	36.01	*
Franklin	4.23	8.44	15.78	60.58	11.67	15.71	76.52
Gasconade	5.64	11.05	22.18	*	15.94	19.45	*
Howard	8.58	17.28	31.20	*	24.06	23.85	*
Jefferson	4.47	8.79	19.28	74.53	12.14	15.24	89.30
Mississippi	18.02	23.95	60.77	*	27.96	48.24	*
Moniteau	9.03	20.50	39.55	*	32.06	56.23	*
Montgomery	6.72	12.76	25.08	*	18.22	21.50	*
New Madrid	15.35	25.73	48.63	*	31.11	47.85	*
Osage	5.60	11.70	21.34	*	17.23	24.13	*
Pemiscot	19.85	26.66	93.13	*	31.81	50.86	*
Perry	6.18	10.16	20.51	*	13.25	18.13	*
St. Charles	7.29	10.88	19.60	*	14.21	17.74	*
St. Louis	11.81	19.67	29.34	55.77	24.46	25.90	65.73
Ste. Genevieve	5.01	10.41	19.93	87.81	14.44	17.83	*
Scott	15.27	20.48	51.18	*	24.50	38.51	*
Stoddard	9.65	16.33	31.29	*	21.00	32.23	*
Warren	5.84	9.68	20.92	*	12.41	20.89	*
Total	1.46	2.71	5.09	23.49	3.67	4.76	28.98
State Total	0.53	1.04	1.57	6.34	1.48	2.00	7.86

[1] * indicates a sampling error over 99.00 percent.

[2] Error figures are for average annual growth and removals.

MISSOURI
Major Forest Types
1989

IOWA

NEBRASKA

KANSAS

OKLAHOMA

ARKANSAS

ILLINOIS

KENTUCKY

TENNESSEE

- Nonforest
- Shortleaf Pine-Oak
- Eastern Redcedar-Hardwoods
- Oak-Hickory
- Oak-Gum-Cypress
- Elm-Ash-Cottonwood
- Water

SCALE 1:1,000,000

10 0 10 20 30 40 Miles

10 0 10 20 30 40 50 Kilometers

Compilation Procedure

Forest types were interpreted on the most recent available aerial photography for each county in Missouri at 1:20,000 and 1:40,000 scales using standard forest inventory procedures. The forest type information was recorded on a 1:1,000,000 scale map.
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Prepared by Martinez Corp.

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North Central Forest Experiment Station
Forest Service
U.S. Department of Agriculture
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Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.